COMPUTERIZED REDUCTION OF METEOROLOGIC MEASUREMENTS FROM IRRIGATED AND NONIRRIGATED PLOTS IN CENTRAL UTAH[1]

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Abstract.— Two FORTRAN IV computer programs were developed to facilitate reduction of meteorologic data from irrigated and nonirrigated plots at Provo, Utah. The first program compiles and tabulates daily, monthly, and yearly summaries of precipitation as rain and/or snow, snowfall, total snow cover, soil moisture, dew, relative humidity, potential evaporation, cloud cover, and wind. Temperature values are tabulated for measurements taken in a standard weather shelter, 5 cm beneath soil surface under grass cover, at soil surface under grass cover, and on bare ground.

The second program enables complete computerized (Calcomp) construction, labeling, and graphing of 10 different meteorologic measurements and 3 calculated comparisons of temperature means.

Advantages of the first computer program relate generally to that obviously noticeable with any computerized tabulation. Those of the second program relate more specifically to the greatly reduced cost of computerized graphs compared with those produced manually, as well as to the marked reduction of errors compared with the number frequently associated with the usual tedious and laborious plotting of voluminous weather data.

Meteorologic data collected for the year demonstrated the beneficial effect of irrigation in the creation of microenvironments for living organisms.

Introduction

A comparison of meteorologic measurements from irrigated and nonirrigated plots in Provo, Utah, for 1970 through 1972 was published recently by Andersen, Wright, and Fox (1974). Included in their report was a detailed description of the study area, instrumentation employed, method of handling meteorologic data, and a series of manually reproduced graphs depicting the results for those three years. The current report is designed as a companion article to the one referred to above. It extends the meteorologic measurements through 1973 for an adjacently located plot watered via sprinkling as opposed to flood irrigation used in the previous project. Furthermore, it emphasizes those changes that have been incorporated to enable the graphing of 10 different meteorologic measurements and 3 comparisons of calculated means by a Calcomp plotter.

The importance of irrigation in creating optimum microenvironments for biological organisms has been substantiated for such invertebrates as mosquitoes (Rainy and Hess, 1967; Reeves and Hammon, 1962), snails (World Health Organization, 1950), and nematode larvae (Furman, 1944; Honess and Bergstrom, 1966; Fox, Andersen, and Hoopes, 1970; and Wright and Andersen, 1972). The importance was elaborated upon further by Andersen et al. (1974) and, thus, will not be discussed here.

Description of Experimental Plot

The experimental plot measured 10 x 30 m and was located at the Brigham Young University Animal Science Farm, Provo, Utah, adjacent to the plot used in the study by Andersen et al. (1974). The coordinates of the station site, elevation, description of vegetative cover, soil type and drainage, instrumentation, and method of collecting data were the same as reported earlier. The plot was divided into an irrigated and a nonirrigated section separated by an elevated dike. Additional diking, aproximately 8 in (20 cm) high, was also placed around the upper border and sides of the plot to prevent any flood irrigation waters from entering the experimental area. Beginning in May the irrigated portion was sprinkled each Monday with a total of 1 in (2.5 cm) of water as measured in the rain gauge. This was applied at an approximate rate of 0.5 in/hr. In June the amount was increased to 1.5 in (3.25 cm) and in July to 2 in (5.0 cm). The amounts were reversed for August, September, and October, after which time sprinkling ceased. This regimen for 1973 added a total of 39 in (97.5 cm) of water to the irrigated plot over the six month period.

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Descriptions of Programs

Two FORTRAN IV programs, one for data tabulation and a second for Calcomp graphing, were developed for this project. Figure 1 outlines the collation and handling of meteorological data and Figures 2 and 3 illustrate flow charts for the data tabulation and Calcomp graphing programs respectively. All meteorologic data for the year were entered on specially designed worksheets (Figs. 4 and 5), keypunched on 80-column IBM cards, and handled as diagrammed. All mensural data not already in the metric system were so transposed by appropriate conversion formulae. Also, the printing of all negative or zero values was suppressed whenever such data were not meaningful.

The first program compiles and tabulates daily, monthly, and yearly summaries of all meteorologic data collected. Tables 1, 2, and 3 are sample printouts of one month's data (May 1973), and Tables 4 and 5 are the two-page annual summary sheets.

The second program developed for the project enables complete computerized

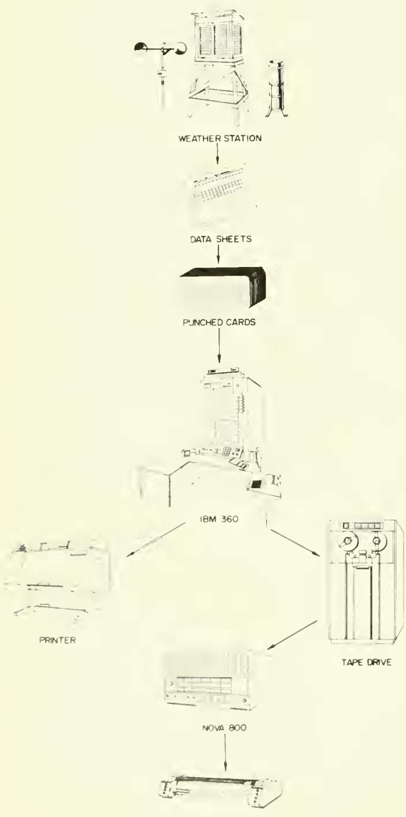


Fig. 1 Diagram showing how meteorologic data were collated and handled.

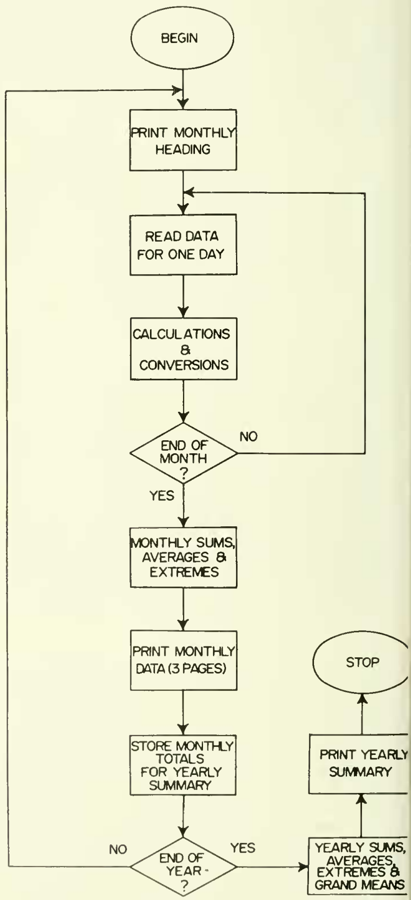


Fig. 2. Flow chart for the data tabulation program.

plotting of 10 different meteorologic measurements and 3 calculated mean temperature comparisons. Each deck of program data for any one year must be preceded by a control card identifying the year and number of days in that year. Also included on the control card for the Calcomp plotting program is a list of identifying numbers which permit selection of desired graphs for that year. These graphs are then completed sequentially as selected.

Figures 6 through 18 depict computerized reproduction of 10 different meterologic measurements taken during 1973 and 3 calculated comparisons of means as indicated on each individual legend. Table 6 gives information for the 1973 data regarding the approximate run times and current costs for the IBM 360/65 installation at Brigham Young University.

The complete printout of all daily, monthly, and yearly data is available upon request for the cost of reproduction. Both computer programs are printed herein (Appendix) for researchers who might find sections or subroutines applicable to their specific needs in meteorology or biology.

Regarding specific handling of meteoro-

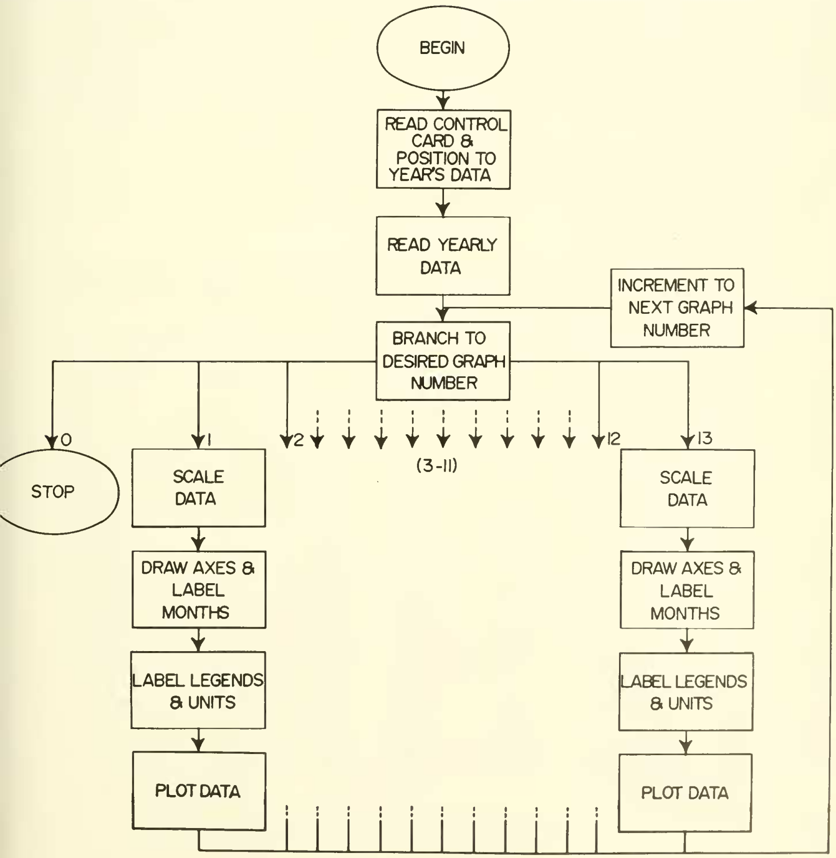


Fig. 3. Flow chart for the Calcomp plotting program.

TABLE 1. Sample monthly summary of measurements on precipitation, soil moisture, relative humidity, potential evaporation, cloud cover, and wind—May 1973.

DAY	DAY OF YEAR	PRECIPITATION (MM) TOTAL PREC	RAIN PREC	SNOW PREC	SNOW FALL	SNOW COVER	SOIL MOISTURE IRRIGATED PERCENT	DEW	IRR*	NON-IRRIG PERCENT	DEW	RELATIVE HUMIDITY MAX	MIN	HRS OF 98-100 REL-HUM	POT EVAP (MM)	CLOUD COVER (0-10)	WIND (KM)
1	121	1.0	1.0					+			+	100	68	18	0.0	5	50
2	122	0.3	0.3									100	24	6	7.0	1	34
3	123							+			+	100	30	2	8.2	5	50
4	124											86	38	0	4.8	5	61
5	125							+			+	100	37	11	2.8	8	50
6	126	0.5	0.5					+			+	100	72	8	8.8	4	66
7	127						12.6	+	+	9.2	+	98	42	4	7.2	5	42
8	128						17.5					100	46	9	10.4	9	56
9	129							+			+	98	26	5	8.6	0	29
10	130							+			+	99	40	6	7.4	1	34
11	131							+			+	98	32	8	9.0	0	24
12	132							+			+	98	34	4	10.0	2	32
13	133							+			+	58	30	0	10.0	0	63
14	134						9.9	+	+	8.9	+	100	32	4	8.4	1	61
15	135						20.7					100	36	6	8.6	0	34
16	136							+			+	100	34	4	13.4	0	37
17	137											100	36	5	10.0	1	37
18	138											100	36	5	10.0	0	42
19	139	2.5	2.5					+			+	100	43	8	11.6	0	61
20	140	0.5	0.5					+			+	100	41	8	6.8	3	55
21	141						8.1	+	+	4.4	+	100	38	6	2.0	7	58
22	142						18.9	+			+	100	38	6	7.6	0	31
23	143							+			+	100	32	1	10.2	0	35
24	144	5.1	5.1									100	36	4	5.2	4	82
25	145	24.1	24.1					+			+	100	82	22	0.2	10	39
26	146											99	44	12	6.6	8	82
27	147							+			+	99	36	8	9.6	0	60
28	148						16.8	+	+	15.3	+	100	35	9	8.8	0	21
29	149						24.1	+			+	100	28	4	9.2	0	34
30	150							+				100	36	7	8.6	0	18
31	151							+				100	38	6	9.2	2	40
TOTALS		34.0	34.0	0.0	0.0	0.0	128.6	23	4	37.7	21				240.2		1418
MEANS		1.1	1.1	0.0	0.0	0.0	16.1			9.4		97	39	6	7.7	2	45
EXTREMES HIGH		24.1	24.1	0.0	0.0	0.0	24.1			15.3		100	82	22	13.4	10	82
LOW		0.0	0.0	0.0	0.0	0.0	8.1			4.4		58	24	0	0.0	0	18

* DATE OF IRRIGATION (MAY THROUGH OCTOBER)

TABLE 2. Sample monthly summary of temperatures measured from a standard weather shelter and at 5 cm beneath soil surface under grass cover—May 1973.

DAY	DAY OF YEAR	WEATHER SHELTER TEMPERATURES: THERMOMETER MAX.	MIN.	MEAN	HYGROTHERMOGRAPH MAX.	MIN.	MEAN	5 CM BENEATH SOIL SURFACE: IRRIGATED MAX.	MIN.	MEAN	NON-IRRIGATED MAX.	MIN.	MEAN
1	121	13.3	-3.3	5.0	8.9	-1.1	3.9	12.0	6.0	9.0	12.0	6.0	9.0
2	122	15.6	0.0	7.8	15.0	0.0	7.5	16.0	8.0	12.0	17.0	7.0	12.0
3	123	21.7	6.7	14.2	21.1	7.8	14.4	19.0	11.0	15.0	30.0	11.0	20.5
4	124	21.1	7.8	14.4	20.6	7.8	14.2	18.0	12.0	15.0	20.0	12.0	16.0
5	125	20.0	5.0	12.5	19.4	5.6	12.5	18.0	11.0	14.5	18.0	11.0	14.5
6	126	18.9	6.7	12.8	18.3	7.8	13.1	18.0	12.0	15.0	20.0	12.0	16.0
7	127	18.9	6.1	12.5	6.1	6.7	6.4	19.0	13.0	16.0	21.0	13.0	17.0
8	128	19.4	2.2	10.8	18.3	2.2	10.3	17.0	10.0	13.5	19.0	10.0	14.5
9	129	23.9	5.0	14.4	23.3	5.6	14.4	20.0	12.0	16.0	23.0	12.0	17.5
10	130	23.3	4.4	13.9	22.2	4.4	13.3	21.0	12.0	16.5	24.0	13.0	18.5
11	131	23.9	6.1	15.0	22.8	5.6	14.2	20.0	10.0	15.0	21.0	11.0	16.0
12	132	26.7	8.3	17.5	25.6	6.7	16.1	23.0	11.0	17.0	23.0	12.0	17.5
13	133	26.1	8.3	17.2	25.6	8.3	16.9	23.0	12.0	17.5	24.0	13.0	18.5
14	134	25.6	6.1	15.8	24.4	6.7	15.6	23.0	10.0	16.5	24.0	12.0	18.0
15	135	25.6	5.6	15.6	25.6	6.1	15.8	25.0	11.0	18.0	24.0	11.0	17.5
16	136	27.8	6.7	17.2	26.7	7.2	16.9	25.0	12.0	18.5	24.0	13.0	18.5
17	137	28.3	7.2	17.8	27.8	7.8	17.8	26.0	13.0	19.5	26.0	13.0	19.5
18	138	30.0	10.0	20.0	28.9	11.1	20.0	24.0	15.0	19.5	27.0	16.0	21.5
19	139	27.8	10.0	18.9	27.2	10.6	18.9	26.0	14.0	20.0	26.0	14.0	20.0
20	140	26.1	10.6	18.3	25.0	11.1	18.1	26.0	15.0	20.5	25.0	15.0	20.0
21	141	23.3	5.0	14.2	21.7	5.6	13.6	25.0	12.0	18.5	26.0	13.0	19.5
22	142	23.9	5.0	14.4	23.3	5.6	14.4	25.0	12.0	18.5	27.0	14.0	20.5
23	143	26.7	10.6	18.6	26.1	11.1	18.6	27.0	15.0	21.0	28.0	16.0	22.0
24	144	27.2	9.4	18.3	26.7	10.0	18.3	25.0	15.0	20.0	27.0	16.0	21.5
25	145	12.2	3.9	8.1	10.0	4.4	7.2	15.0	10.0	12.5	16.0	10.0	13.0
26	146	13.9	0.0	6.9	13.3	1.1	7.2	19.0	9.0	14.0	20.0	10.0	15.0
27	147	17.2	1.7	9.4	15.6	2.2	8.9	20.0	10.0	15.0	22.0	11.0	16.5
28	148	22.2	3.9	13.1	21.1	4.4	12.8	23.0	12.0	17.5	35.0	12.0	23.5
29	149	23.9	6.1	15.0	23.3	6.7	15.0	24.0	12.0	18.0	26.0	13.0	19.5
30	150	25.0	6.7	15.8	24.4	6.7	15.6	24.0	14.0	19.0	27.0	15.0	21.0
31	151	26.1	9.4	17.8	25.6	10.0	17.8	22.0	15.0	18.5	25.0	16.0	20.5
MEANS		22.8	5.8	14.3	21.4	6.3	13.9	21.5	11.8	16.7	23.5	12.4	17.9
EXTREMES HIGH		30.0	10.6		28.9	11.1		27.0	15.0		35.0	16.0	
LOW		12.2	-3.3		6.1	-1.1		12.0	6.0		12.0	6.0	

ALL TEMPERATURES IN DEGREES CELSIUS

TABLE 3. Sample monthly summary of temperatures measured from a standard weather shelter, at soil surface under grass cover, and on bare soil surface—May 1973.

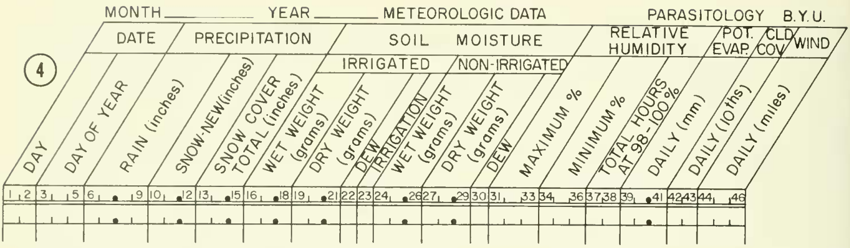
		WEATHER SHELTER			SOIL SURFACE UNDER GRASS COVER						BARE SOIL SURFACE					
	DAY OF	THERMOMETER			IRRIGATED			NON-IRRIGATED			IRRIGATED			NON-IRRIGATED		
DAY	YEAR	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN
1	121	13.3	-3.3	5.0	18.0	4.0	11.0	18.0	3.0	10.5	29.0	-1.0	14.0	32.0	0.0	16.0
2	122	15.6	0.0	7.8	20.0	6.0	13.0	24.0	5.0	14.5	36.0	0.0	18.0	37.0	1.0	19.0
3	123	21.7	6.7	14.2	23.0	9.0	16.0	32.0	9.0	20.5	43.0	5.0	24.0	44.0	7.0	25.5
4	124	21.1	7.8	14.4	26.0	10.0	18.0	17.0	10.0	13.5	45.0	6.0	25.5	47.0	8.0	27.5
5	125	20.0	5.0	12.5	21.0	9.0	15.0	24.0	9.0	16.5	41.0	5.0	23.0	42.0	6.0	24.0
6	126	18.9	6.7	12.8	22.0	11.0	16.5	24.0	11.0	17.5	42.0	6.0	24.0	45.0	7.0	26.0
7	127	18.9	6.1	12.5	24.0	11.0	17.5	26.0	12.0	19.0	47.0	6.0	26.5	52.0	8.0	30.0
8	128	19.4	2.2	10.8	20.0	8.0	14.0	22.0	8.0	15.0	38.0	2.0	20.0	42.0	4.0	23.0
9	129	23.9	5.0	14.4	25.0	10.0	17.5	28.0	10.0	19.0	50.0	-1.0	24.5	55.0	6.0	30.5
10	130	23.3	4.4	13.9	25.0	10.0	17.5	30.0	10.0	20.0	52.0	3.0	27.5	55.0	0.0	27.5
11	131	23.9	6.1	15.0	32.0	10.0	21.0	30.0	8.0	19.0	39.0	8.0	23.5	39.0	4.0	21.5
12	132	26.7	8.3	17.5	38.0	10.0	24.0	35.0	9.0	22.0	50.0	8.0	29.0	51.0	4.0	27.5
13	133	26.1	8.3	17.2	37.0	11.0	24.0	35.0	9.0	22.0	52.0	9.0	30.5	52.0	0.0	26.0
14	134	25.6	6.1	15.8	42.0	10.0	26.0	36.0	8.0	22.0	54.0	8.0	31.0	55.0	4.0	29.5
15	135	25.6	5.6	15.6	40.0	10.0	25.0	35.0	8.0	21.5	55.0	7.0	31.0	57.0	2.0	29.5
16	136	27.8	6.7	17.2	43.0	11.0	27.0	36.0	9.0	22.5	56.0	9.0	32.5	58.0	4.0	31.0
17	137	28.3	7.2	17.8	43.0	12.0	27.5	39.0	10.0	24.5	59.0	10.0	34.5	58.0	5.0	31.5
18	138	30.0	10.0	20.0	42.0	15.0	28.5	41.0	16.0	28.5	60.0	15.0	37.5	59.0	10.0	34.5
19	139	27.8	10.0	18.9	49.0	14.0	31.5	43.0	12.0	27.5	61.0	12.0	36.5	61.0	8.0	34.5
20	140	26.1	10.6	18.3	46.0	14.0	30.0	37.0	13.0	25.0	52.0	13.0	32.5	53.0	8.0	30.5
21	141	23.3	5.0	14.2	36.0	12.0	24.0	38.0	9.0	23.5	32.0	9.0	20.5	53.0	4.0	28.5
22	142	23.9	5.0	14.4	44.0	9.0	26.5	43.0	9.0	26.0	45.0	9.0	27.0	57.0	4.0	30.5
23	143	26.7	10.6	18.6	45.0	13.0	29.0	40.0	13.0	26.5	50.0	14.0	32.0	60.0	10.0	35.0
24	144	27.2	9.4	18.3	47.0	14.0	30.5	45.0	14.0	29.5	52.0	9.0	30.5	59.0	11.0	35.0
25	145	12.2	3.9	8.1	18.0	4.0	11.0	17.0	7.0	12.0	17.0	7.0	12.0	15.0	3.0	9.0
26	146	13.9	0.0	6.9	34.0	8.0	21.0	27.0	7.0	17.0	31.0	6.0	18.5	28.0	2.0	15.0
27	147	17.2	1.7	9.4	36.0	8.0	22.0	31.0	8.0	19.5	37.0	6.0	21.5	38.0	5.0	21.5
28	148	22.2	3.9	13.1	32.0	11.0	21.5	36.0	10.0	23.0	34.0	9.0	21.5	47.0	7.0	27.0
29	149	23.9	6.1	15.0	40.0	11.0	25.5	39.0	10.0	24.5	38.0	9.0	23.5	51.0	8.0	29.5
30	150	25.0	6.7	15.8	39.0	12.0	25.5	39.0	12.0	25.5	43.0	11.0	27.0	52.0	10.0	31.0
31	151	26.1	9.4	17.8	39.0	14.0	26.5	38.0	14.0	26.0	46.0	14.0	30.0	53.0	12.0	32.5
MEANS		22.8	5.8	14.3	33.7	10.4	22.0	32.4	9.7	21.1	44.7	7.5	26.1	48.6	5.5	27.1
EXTREMES																
HIGH		30.0	10.6		49.0	15.0		45.0	16.0		61.0	15.0		61.0	12.0	
LOW		12.2	-3.3		18.0	4.0		17.0	3.0		17.0	-1.0		15.0	0.0	

ALL TEMPERATURES IN DEGREES CELSIUS

Table 4. Yearly summary of measurements on precipitation, soil moisture, relative humidity, potential evaporation, cloud cover, and wind—1973.

		PRECIPITATION (MM)					SOIL MOISTURE (PERCENT)		RELATIVE HUMIDITY					
MONTH		TOTAL PREC	RAIN PREC	SNOW PREC	SNOW FALL	SNOW COVER	IRRG	NON-IRRG	MAX	MIN	HRS OF 98-100 REL HUM	POT EVAP (MM)	CLOUD COVER (0-10)	WIND (KM)
JANUARY	TOTAL	29.7	0.0	29.7	297.2	3302.0	--	--	--	--	--	ND	--	1183
	MEAN	1.0	0.0	1.0	9.6	106.5	ND	ND	98	76	17	ND	6	38
FEBRUARY	TOTAL	33.8	31.7	2.0	20.3	363.2	--	--	--	--	--	ND	--	1144
	MEAN	1.2	1.1	0.1	0.7	13.0	ND	ND	98	66	14	ND	5	40
MARCH	TOTAL	86.6	58.7	27.9	279.4	287.0	--	--	--	--	--	ND	--	2012
	MEAN	2.8	1.9	0.9	9.0	9.3	ND	ND	98	57	11	ND	6	64
APRIL	TOTAL	44.4	33.0	11.4	114.3	114.3	--	--	--	--	--	ND	--	1901
	MEAN	1.5	1.1	0.4	3.8	3.8	ND	ND	98	50	8	ND	4	63
MAY	TOTAL	34.0	34.0	0.0	0.0	0.0	--	--	--	--	--	240.2	--	1418
	MEAN	1.1	1.1	0.0	0.0	0.0	16.1	9.4	97	39	6	7.7	2	45
JUNE	TOTAL	18.3	18.3	0.0	0.0	0.0	--	--	--	--	--	268.6	--	1215
	MEAN	0.6	0.6	0.0	0.0	0.0	20.6	8.9	97	35	5	9.0	2	40
JULY	TOTAL	19.8	19.8	0.0	0.0	0.0	--	--	--	--	--	299.0	--	889
	MEAN	0.6	0.6	0.0	0.0	0.0	16.7	4.0	99	39	7	9.6	1	28
AUGUST	TOTAL	51.8	51.8	0.0	0.0	0.0	--	--	--	--	--	368.4	--	1061
	MEAN	1.7	1.7	0.0	0.0	0.0	31.2	11.7	98	34	7	11.9	1	34
SEPTEMBER	TOTAL	39.4	39.4	0.0	0.0	0.0	--	--	--	--	--	197.8	--	766
	MEAN	1.3	1.3	0.0	0.0	0.0	26.1	12.4	99	46	9	6.6	2	25
OCTOBER	TOTAL	13.2	13.2	0.0	0.0	0.0	--	--	--	--	--	88.4	--	1198
	MEAN	0.4	0.4	0.0	0.0	0.0	25.7	10.1	99	42	8	2.9	2	38
NOVEMBER	TOTAL	80.5	17.0	63.5	635.0	1531.6	--	--	--	--	--	ND	--	1210
	MEAN	2.7	0.6	2.1	21.2	51.1	ND	ND	99	58	11	ND	5	40
DECEMBER	TOTAL	45.0	0.0	45.0	449.6	970.3	--	--	--	--	--	ND	--	1329
	MEAN	1.5	0.0	1.5	14.5	31.3	ND	ND	99	69	15	ND	5	42
YEARLY TOTAL		496.6	317.0	179.6	1795.8	6568.4	--	--	--	--	--	1462.4*	--	15326
GRAND MEAN		1.4	0.9	0.5	4.9	17.9	22.7*	9.4*	98	50	9	7.9*	3	41

ND = NOT DETERMINED
* CALCULATED 1 MAY THROUGH 31 OCTOBER ONLY



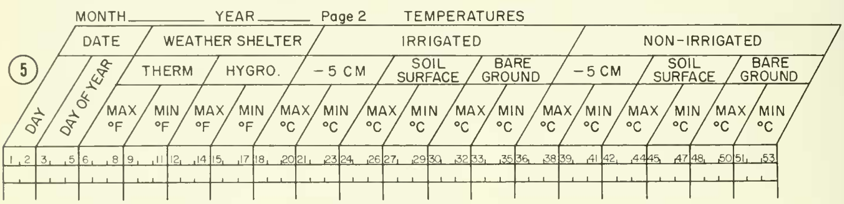


TABLE 5. Yearly summary of temperatures measured in a standard weather shelter, at 5 cm beneath soil surface under grass cover, at soil surface under grass cover, and on bare soil surface—1973.

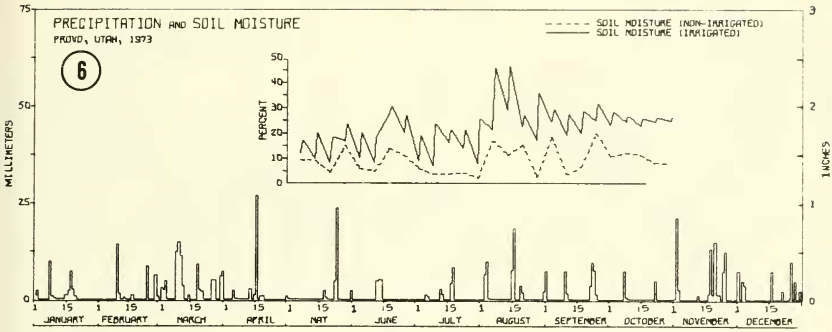
	WEATHER SHELTER TEMPERATURES						5 CM BENEATH SOIL SURFACE					
	THERMOMETER			HYGROTHERMOGRAPH			IRRIGATED			NON-IRRIGATED		
MONTH	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN
JANUARY	0.6	-12.6	-6.0	-1.1	-11.4	-6.2	-3.4	-4.2	-3.8	-2.4	-3.4	-2.9
FEBRUARY	6.6	-6.3	0.2	5.1	-5.9	-0.4	-1.8	-3.5	-2.7	-0.9	-2.4	-1.6
MARCH	9.0	-3.2	2.9	7.7	-2.5	2.6	4.0	-1.2	1.4	6.1	0.2	3.1
APRIL	12.9	-0.7	6.1	11.6	0.1	5.8	8.4	1.9	5.1	10.5	3.2	6.9
MAY	22.8	5.8	14.3	21.4	6.3	13.9	21.5	11.8	16.7	23.5	12.4	17.9
JUNE	27.4	8.9	18.2	26.7	9.5	18.1	24.7	15.2	19.9	29.7	16.6	23.1
JULY	31.0	12.4	21.7	30.8	13.3	22.0	28.1	19.1	23.6	34.5	20.2	27.4
AUGUST	31.5	11.8	21.6	31.0	12.8	21.9	26.5	18.4	22.5	31.9	18.8	25.4
SEPTEMBER	23.3	5.5	14.4	22.9	6.7	14.8	19.1	12.6	15.8	22.6	12.1	17.4
OCTOBER	19.4	2.1	10.7	19.0	3.2	11.1	13.0	7.9	10.5	16.2	7.5	11.9
NOVEMBER	9.9	-2.2	3.9	9.3	-1.2	4.0	4.7	2.5	3.6	5.4	2.2	3.8
DECEMBER	5.2	-5.6	-0.2	4.9	-4.7	0.1	0.7	-0.7	-0.0	0.4	-1.1	-0.4
GRAND MEAN	16.6	1.3	9.0	15.8	2.2	9.0	12.1	6.6	9.4	14.8	7.2	11.0

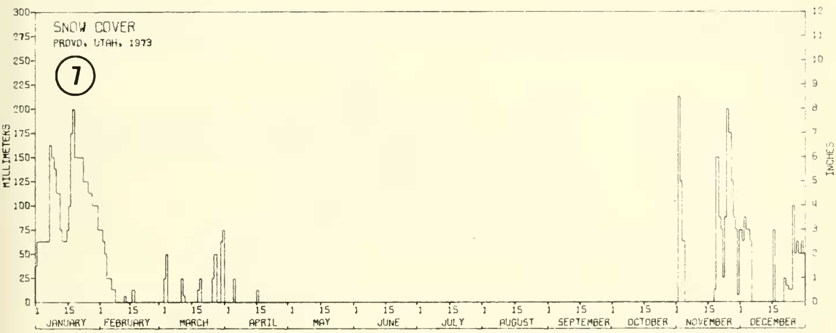
	SOIL SURFACE UNDER GRASS COVER						BARE SOIL SURFACE					
	IRRIGATED			NON-IRRIGATED			IRRIGATED			NON-IRRIGATED		
MONTH	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN	MAX.	MIN.	MEAN
JANUARY	-1.9	-2.5	-2.2	-2.7	-4.2	-3.4	-3.1	-4.5	-3.8	-2.8	-3.9	-3.4
FEBRUARY	1.0	-2.4	-0.7	2.0	-2.9	-0.5	6.5	-5.6	0.4	5.8	-4.3	0.8
MARCH	7.9	-0.3	3.8	10.0	-1.0	4.5	17.5	-4.4	6.5	18.6	-3.1	7.8
APRIL	12.4	2.6	7.5	15.7	2.1	8.9	25.1	-2.4	11.3	29.3	-1.0	14.1
MAY	33.7	10.4	22.0	32.4	9.7	21.1	44.7	7.5	26.1	48.6	5.5	27.1
JUNE	41.2	13.4	27.3	43.1	13.3	28.2	46.2	12.7	29.4	57.5	10.3	33.9
JULY	35.7	19.8	27.8	50.9	16.4	33.6	44.9	16.3	30.6	62.8	14.5	38.7
AUGUST	32.6	19.5	26.0	44.3	15.9	30.1	44.0	15.8	29.9	55.5	14.2	34.9
SEPTEMBER	24.8	13.4	19.1	31.3	9.7	20.5	33.3	10.1	21.7	40.6	8.0	24.3
OCTOBER	18.0	9.0	13.5	22.8	5.1	14.0	25.1	6.4	15.7	32.8	2.4	17.6
NOVEMBER	8.0	4.3	6.2	7.8	1.2	4.5	12.6	1.8	7.2	12.6	0.0	6.3
DECEMBER	3.5	1.3	2.4	1.8	-1.2	0.3	6.3	-0.4	3.0	4.1	-2.1	1.0
GRAND MEAN	18.1	7.4	12.7	21.6	5.3	13.5	25.3	4.4	14.8	30.5	3.4	16.9

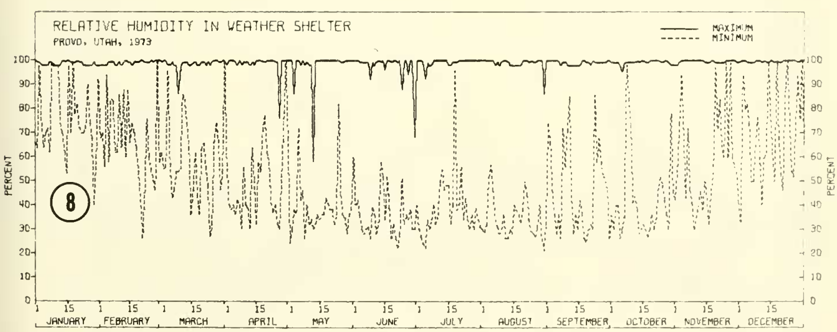
ALL TEMPERATURES IN DEGREES CELSIUS

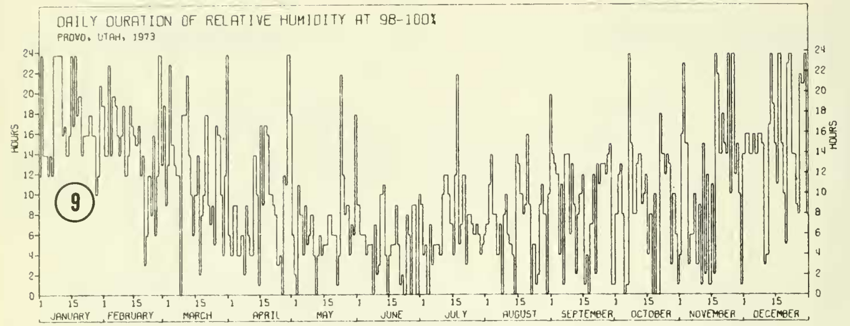
Table 6. 1973 data for time and costs for weather data tabulation and Calcomp plotting programs using the IBM 360/65 installation at Brigham Young University.

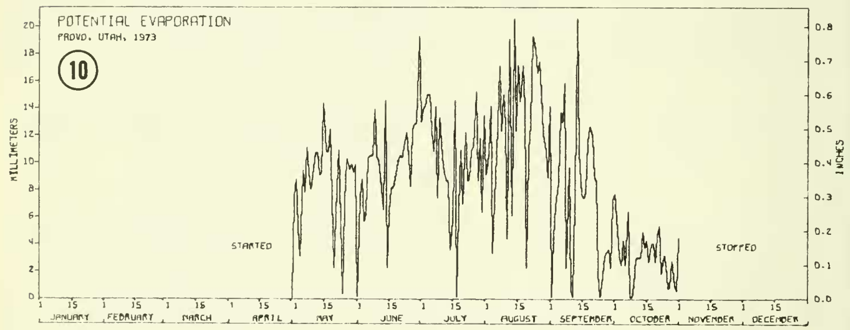
Program	Turn around time	Compiler costs	Run costs	Plotter costs	Total
Weather data tabulation	0.5 hr	$6.75	$ 7.50	--	$14.25
Calcomp graphics	2.0 hr	$7.00	$13.00	$5.00	$25.00
					$39.25

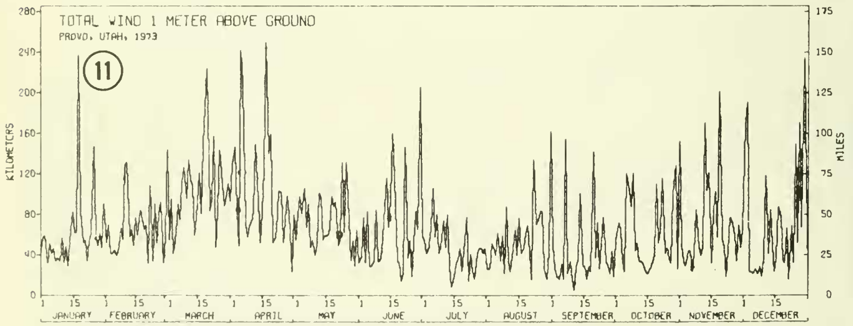

PRECIPITATION AND SOIL MOISTURE
PROVO, UTAH, 1973
6
SOIL MOISTURE (NON-IRRIGATED)
SOIL MOISTURE (IRRIGATED)
MILLIMETERS
INCHES
PERCENT
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

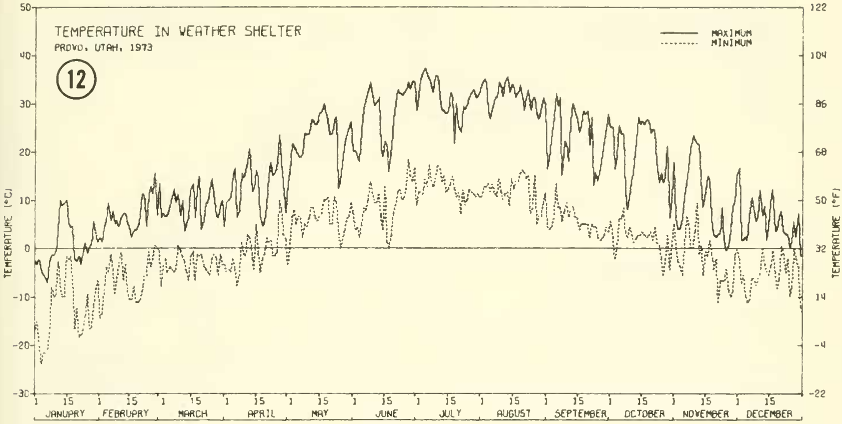

SNOW COVER
PROVO, UTAH, 1973
7
MILLIMETERS
INCHES
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

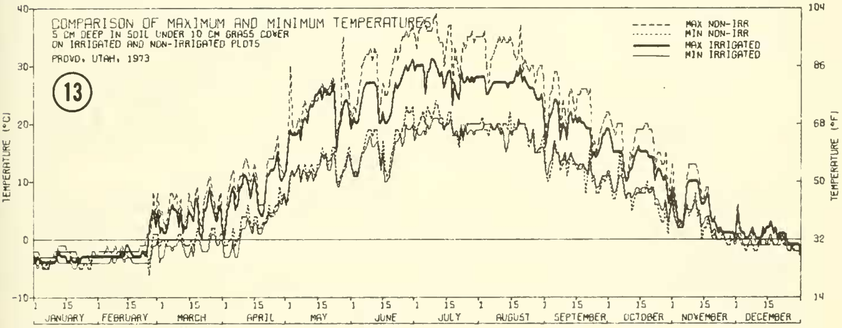

RELATIVE HUMIDITY IN WEATHER SHELTER
PROVO, UTAH, 1973
MAXIMUM
MINIMUM
8
PERCENT
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

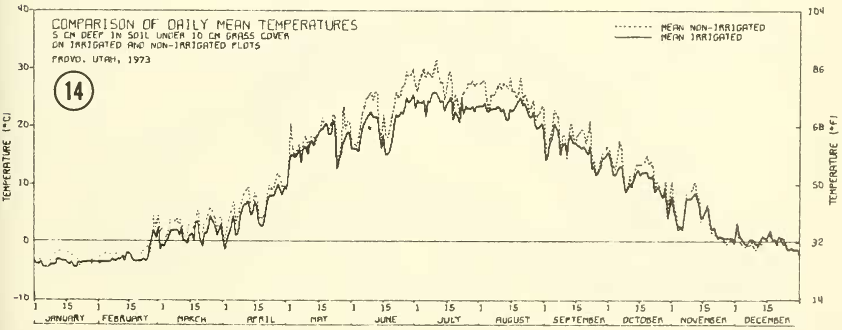

DAILY DURATION OF RELATIVE HUMIDITY AT 98-100%
PROVO, UTAH, 1973
9
HOURS
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

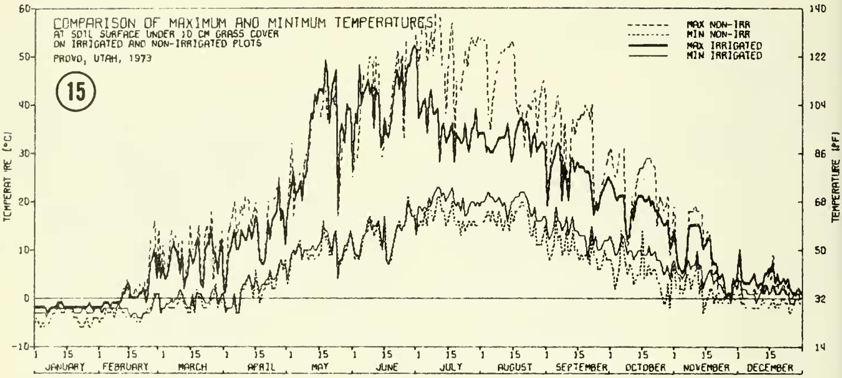

POTENTIAL EVAPORATION
PROVO, UTAH, 1973
10
MILLIMETERS
INCHES
STARTED
STOPPED
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

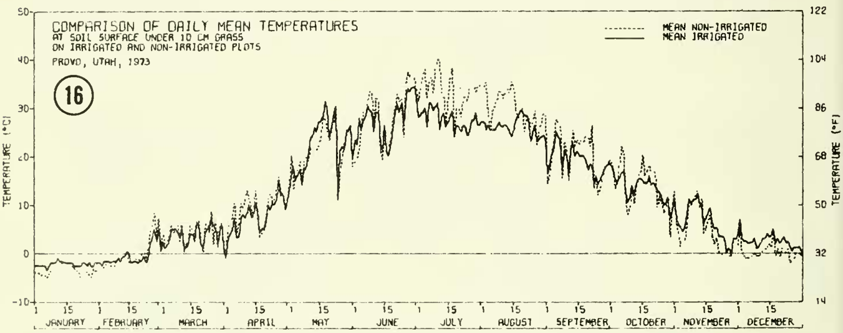

TOTAL WIND 1 METER ABOVE GROUND
PROVO, UTAH, 1973
11
KILOMETERS
MILES
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

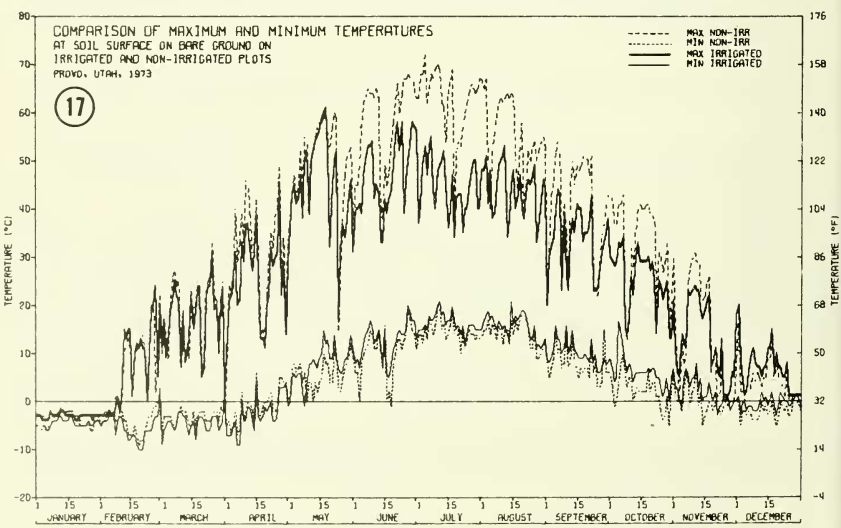

TEMPERATURE IN WEATHER SHELTER
PROVO, UTAH, 1973
12
MAXIMUM
MINIMUM
TEMPERATURE (°C)
TEMPERATURE (°F)
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

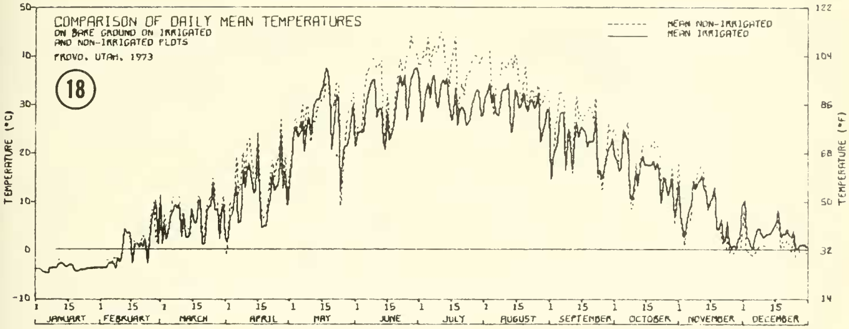

COMPARISON OF MAXIMUM AND MINIMUM TEMPERATURES
5 CM DEEP IN SOIL UNDER 10 CM GRASS COVER
ON IRRIGATED AND NON-IRRIGATED PLOTS
PROVO, UTAH, 1973
13
MAX NON-IRR
MIN NON-IRR
MAX IRRIGATED
MIN IRRIGATED
TEMPERATURE (°C)
TEMPERATURE (°F)
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER


COMPARISON OF DAILY MEAN TEMPERATURES
5 CM DEEP IN SOIL UNDER 10 CM GRASS COVER
ON IRRIGATED AND NON-IRRIGATED PLOTS
PROVO, UTAH, 1973
14
MEAN NON-IRRIGATED
MEAN IRRIGATED
TEMPERATURE (°C)
TEMPERATURE (°F)
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER


COMPARISON OF MAXIMUM AND MINIMUM TEMPERATURES
AT SOIL SURFACE UNDER 10 CM GRASS COVER
ON IRRIGATED AND NON-IRRIGATED PLOTS
PROVO, UTAH, 1973
15
MAX NON-IRR
MIN NON-IRR
MAX IRRIGATED
MIN IRRIGATED
TEMPERATURE (°C)
TEMPERATURE (°F)
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER


COMPARISON OF DAILY MEAN TEMPERATURES
AT SOIL SURFACE UNDER 10 CM GRASS
ON IRRIGATED AND NON-IRRIGATED PLOTS
PROVO, UTAH, 1973
16
MEAN NON-IRRIGATED
MEAN IRRIGATED
TEMPERATURE (°C)
TEMPERATURE (°F)
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER


COMPARISON OF MAXIMUM AND MINIMUM TEMPERATURES
AT SOIL SURFACE ON BARE GROUND ON
IRRIGATED AND NON-IRRIGATED PLOTS
PROVO, UTAH, 1973
17
MAX NON-IRR
MIN NON-IRR
MAX IRRIGATED
MIN IRRIGATED
TEMPERATURE (°C)
TEMPERATURE (°F)
JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER



logic information from the pasture plots as well as certain calculations and conversions by the computer, the following clarifications may be warranted. All measurements of precipitation as rain are measured and entered in fractions of inches and then converted before tabulation into millimeter units. New snow and total snow cover are similarly handled. Precipitation as snow is calculated as one-tenth that of total snowfall for any one day. Soil moisture samples were determined as described previously by Andersen et al. (1974), with the exception that two samples were taken each week from the irrigated plot—one just prior to sprinkling of the plot and the second 24 hr later. Only one weekly sample was taken from the nonirrigated plot. The weight in grams of each sample was entered as an original wet weight and then as a dry weight determined after 24 hr storage at 105 C.

Programmed formulae calculated the percent soil moisture by dividing the difference in the wet and dry weight for each sample by the dry weight value. This percent was then printed on the first printout page for each of the six months that irrigation was used. The presence or absence of dew on each plot was noted for each morning during those six months and recorded as a "+" when present. Irrigation by sprinkling was performed each Monday during the six-month period and also indicated with a "+" on the appropriate dates.

Relative humidity (RH) maxima and minima, as well as the total number of hours each day at which 98-100 percent RH occurred, were entered and printed out directly. The evaporating pan on the instrument that measured potential evaporation was filled each morning, and the daily water loss noted for the following 24 hr was entered in mm and also printed out directly. Since evaporation could not be read in freezing weather, the measurement was taken only during May through October, those same months during which the one plot was irrigated. A difficulty ensued whenever rain occurred because the evaporating pan held only 20 mm of water and refilled partially or completely on any day during which rain fell. Thus, any potential evaporation which may have occurred on such days was invariably negated to some degree by the rain that collected in the evaporating pan. Nevertheless, the recording evaporimeter used in the study gave a much more accurate reflection of the potential evaporation with its shallow pan (20 mm) than do the large evaporation tanks used by the U.S. Weather Bureau. In those tanks the water level is frequently 4-6 in (10-15 cm) below the upper rim of the pan and hence protected markedly from the evaporating effect of wind currents.

Any evaluation of daily cloud cover was determined visually each morning and recorded in tenths. The evaluation indicated the approximate portion of the sky that was covered sufficiently with clouds to cast a shadow at the time the instruments were read. It was thus the most subjective of all measurements taken but, nevertheless, provided some estimation of cloud cover in this region. Wind totals were entered in mile units read from the anemometer dial each day, calculated as the difference from the value of the pre-

ceding day, and converted and printed out as kilometers. The final daily wind total for any preceding year is listed as a starting value and included on the control card for the main program.

Maximum and minimum temperatures monitored from a standard weather shelter, from 5 cm beneath soil surface under grass cover, from soil surface under grass cover, or from bare ground were recorded, converted to Celsius if not already in those units, and printed onto the second and third sheets for each month's data. Means and extremes for all values were stored for eventual calculation of totals and grand means for the annual summary pages.

Daily maximum and minimum temperatures were measured in the weather shelter by mercury- and alcohol-filled thermometers as well as by a standard hygrothermograph. Differences noted in the recorded temperatures relate mainly to the longer time lag required by the bimetallic sensor within the thermograph unit.

Discussion

The main objective of this paper was to present the computer programs developed for our research on the effect of irrigation on pasture microenvironments. These programs have proved extremely satisfactory to us, and hopefully some sections or subroutines will be of value to others engaged in related research projects. Mitchell and Andersen (1969) reported on a computer program, developed at the University of Illinois at Urbana, for handling meteorologic data collected from grass plots. Certain similarities exist between that program and the one reported here, since the choice of meteorologic instruments and the overall research projects at the two institutions were closely correlated. The program at Illinois, however, was designed to handle some additional measurements not taken in the current study, such as solar radiation. The Illinois study also gave emphasis to conversion data for a series of soil-moisture and soil-temperature measurements obtained through moisture-cell leads (wafers) and built-in thermistor units. The programs developed at BYU use data on soil moisture only from simplified gravimetric measurements but include the techniques designed for Calcomp graphing as well. The advantage of this plotting program is not only in the funds saved through not having to manually plot, trace, and label all such graphs but more particularly in the marked reduction of errors that invariably accompany the tedious and laborious tasks encountered in manually plotting daily weather data.

The impact of irrigation on the moisture and temperature profiles in central Utah during 1973 was essentially the same as that reported for 1970-72 by Andersen et al. (1974). Grand mean temperatures for 5 cm beneath soil surface under grass cover, at soil surface under grass cover, or on bare soil surface were consistently lower on the irrigated plot than on the nonirrigated area. These temperature differences were most apparent during the warm summer months when irrigation is commonly employed throughout the region. In July, for example, the month during which most yearly maxima were recorded, the average monthly maximum temperatures measured 5 cm beneath soil surface under grass cover on irrigated and nonirrigated plots differed by 6.4 C, by 15.2 C for those measured at soil surface under grass cover, and by 17.9 C on bare ground. During the six months when no irrigation occurred, the differences were not so apparent; hence the grand means for the year do not give an accurate reflection of these temperature ranges for the irrigation season.

The contrast between soil moisture measurements in the two plots was readily apparent for the six months during which soil samples were gravimetrically analyzed for moisture content. The grand mean for the percent soil moisture for that period was 22.7 percent for the samples removed from the irrigated section and 9.4 percent for those from the nonirrigated area.

Other meteorologic measurements which were taken, such as the precipitation pattern for rain or snow, relative humidity, potential evaporation, and wind, were monitored for both sections combined, since the instruments used could not detect differences from microenvironments. The general pattern of these values was similar to that recorded for previous years. The collective data for 1973 emphasize the marked beneficial impact of irrigation in creating favorable microenvironments for living organisms.

Appendix

```
C       ***********************************************************************
C       *                                                                     *
C       *          WEATHER DATA ANALYSIS, PART I                              *
C       *                                                                     *
C       *          DEVELOPED BY FERRON ANDERSON, BYU                          *
C       *          PROGRAMMED BY PAUL ROSS ROPER, ERI                         *
C       *                                                                     *
C       ***********************************************************************
C
        INTEGER  NDAYS, DAY, DYR, DEW1, IRRG, DEW2, HHUM, LHUM, THRS,
       A         CLCV, WIND, OLDW, S2(26,5), MON(12), HOLD, MONTH(13,3)/
       B         'JANU', 'FEBR', 'MARC', 'APRI', 'MAY ', 'JUNE', 'JULY',
       C         'AUGU', 'SEPT', 'OCTO', 'NOVE', 'DECE', 'GRAN', 'ARY ',
       D         'UARY', 'H   ', 'L   ', 3*'  ', 'ST  ', 'EMBE', 'BER ',
       E         'MBER', 'MBER', 'D ME', 8*'  ', 'R   ', 3*'  ', 'AN  '/
        REAL     TPRE, RAIN, PRSN, SNOW, SNCV, MOSI, MOSN, PEVP, IRWW,
       A         IRDW, NIWW, NIDW, T(34,16), S1(26,8), S3(13,24),
       B         PAGE2(34,12), PAGE3(34,15)
        COMMON   NDAYS, DAY(31), DYR(31), TPRE(35), RAIN(35), PRSN(35),
       A         SNOW(35), SNCV(35), MOSI(35), DEW1(32), IRRG(32),
       B         MOSN(35), DEW2(32), HHUM(35), LHUM(35), THRS(35),
       C         PEVP(35), CLCV(35), WIND(35)
        DATA S1,S2,S3 /208*0.0, 130*0, 312*0.0/
C       TAPE ID
        DATA ITAPE /5/
        CENT(X) = (X-32.0)*5.0/9.0
C
C       REWIND ITAPE
C
C       LOOK FOR CORRECT YEAR
C
      1 READ(5,200,END=999) NYEAR
      2 READ(ITAPE,200,END=999) IYEAR, IDAYS, MON, OLDW
        IF(IYEAR.EQ.NYEAR) GO TO 4
        DO 3 I=1,IDAYS
        READ(ITAPE,200,END=999)
      3 CONTINUE
        GO TO 2
C
C
C       PROCESS DATA PAGE BY PAGE
C
      4 DO 900 II=1,12
        CALL HEAD (IYEAR,II,1,MONTH)
        NDAYS = MON(II)
C
C       WRITE PAGE 1 HEADING
C
        WRITE(6,120)
        DO 10 I=1,NDAYS
        READ(ITAPE,201) DAY(I), DYR(I), RAIN(I), SNOW(I), SNCV(I), IRWW,
       A                IRDW, DEW1(I), IRRG(I), NIWW, NIDW, DEW2(I),
       B                HHUM(I), LHUM(I), THRS(I), PEVP(I), CLCV(I),
       C                WIND(I), (T(I,J),J=1,16)
        PRSN(I) = SNOW(I) * 0.1
        TPRE(I) = RAIN(I) + PRSN(I)
        IF(OLDW.GT.WIND(I)) OLDW = OLDW - 1000
        HOLD = WIND(I)
        WIND(I) = (WIND(I) - OLDW) * 1.6093 + 0.5
        OLDW = HOLD
        MOSI(I) = 0.0
        MOSN(I) = 0.0
        IF(IRWW.NE.0.0) MOSI(I) = (IRWW - IRDW) * 100 / IRDW
        IF(NIWW.NE.0.0) MOSN(I) = (NIWW - NIDW) * 100 / NIDW
        CALL PRINTL (I,II)
        PAGE2(I,1)  = CENT(T(I,1))
        PAGE2(I,2)  = CENT(T(I,2))
        PAGE2(I,4)  = CENT(T(I,3))
        PAGE2(I,5)  = CENT(T(I,4))
        PAGE2(I,7)  = T(I,5)
        PAGE2(I,8)  = T(I,6)
        PAGE2(I,10) = T(I,11)
```

```
      PAGE2(I,11) = T(I,12)
      PAGE3(I,1)  = PAGE2(I,1)
      PAGE3(I,2)  = PAGE2(I,2)
      PAGE3(I,4)  = T(I,7)
      PAGE3(I,5)  = T(I,8)
      PAGE3(I,7)  = T(I,13)
      PAGE3(I,8)  = T(I,14)
      PAGE3(I,10) = T(I,9)
      PAGE3(I,11) = T(I,10)
      PAGE3(I,13) = T(I,15)
      PAGE3(I,14) = T(I,16)
   10 CONTINUE
C
C
      CALL SUMR (TPRE)
      CALL SUMR (RAIN)
      CALL SUMR (PRSN)
      CALL SUMR (SNOW)
      CALL SUMR (SNCV)
      CALL SUMR (PEVP)
      CALL SUMZ (MOSI)
      CALL SUMZ (MOSN)
      CALL SUMI (HHUM)
      CALL SUMI (LHUM)
      CALL SUMI (THRS)
      CALL SUMI (CLCV)
      CALL SUMI (WIND)
      CALL SUMC (IRRG)
      CALL SUMC (DEW1)
      CALL SUMC (DEW2)
C
C     PAGE 1 OF WEATHER DATA
C
      IF(II.LT.5.OR.II.GT.10) GOTO 20
      WRITE(6,121) TPRE(32), RAIN(32), PRSN(32), SNOW(32), SNCV(32),
     A             MOSI(32), DEW1(32), IRRG(32), MOSN(32), DEW2(32),
     B             PEVP(32), WIND(32)
      WRITE(6,122) (TPRE(I), RAIN(I), PRSN(I), SNOW(I), SNCV(I),
     A              MOSI(I), MOSN(I), HHUM(I), LHUM(I), THRS(I),
     B              PEVP(I), CLCV(I), WIND(I),I=33,35)
      GOTO 30
   20 WRITE(6,123) TPRE(32), RAIN(32), PRSN(32), SNOW(32), SNCV(32),
     A             WIND(32)
      WRITE(6,124) (TPRE(I), RAIN(I), PRSN(I), SNOW(I), SNCV(I),
     A             HHUM(I), LHUM(I), THRS(I), CLCV(I), WIND(I),I=33,35)
C
C
C     PAGE 2 OF WEATHER DATA
C
   30 CALL HEAD (IYEAR,II,2,MONTH)
      CALL CALC (PAGE2,12)
      WRITE(6,130)
      DO 31 I=1,NDAYS
   31 WRITE(6,131) DAY(I), DYR(I), (PAGE2(I,J),J=1,12)
      WRITE(6,132) ((PAGE2(I,J),J=1,12),I=32,34)
C
C     PAGE 3 OF WEATHER DATA
C
      CALL HEAD (IYEAR,II,3,MONTH)
      CALL CALC (PAGE3,15)
      WRITE(6,140)
      DO 40 I=1,NDAYS
   40 WRITE(6,141) DAY(I), DYR(I), (PAGE3(I,J),J=1,15)
      WRITE(6,142) ((PAGE3(I,J),J=1,15),I=32,34)
C
C     STORE DATA FOR YEARLY SUMMARY PAGES
C
      DO 50 J=1,2
      K = II * 2 + J - 2
      S1(K,1) = TPRE(31+J)
      S1(K,2) = RAIN(31+J)
      S1(K,3) = PRSN(31+J)
      S1(K,4) = SNOW(31+J)
      S1(K,5) = SNCV(31+J)
      S1(K,6) = MOSI(31+J)
```

```
            S1(K,7) = MOSN(31+J)
            S1(K,8) = PEVP(31+J)
         50 S2(K,5) = WIND(31+J)
            S2(K,1) = HHUM(33)
            S2(K,2) = LHUM(33)
            S2(K,3) = THRS(33)
            S2(K,4) = CLCV(33)
            DO 51 J=1,12
            S3(II,J) = PAGE2(32,J)
         51 S3(II,J+12) = PAGE3(32,J+3)
        900 CONTINUE
      C
      C
      C     YEARLY SUMMARY PAGE
      C
            DO 54 J=1,8
            S1(25,J) = 0.0
            S1(26,J) = 0.0
            DO 53 I=1,12
            IF(J.LT.6) GO TO 52
            IF(I.LT.5.OR.I.GT.10) GO TO 53
         52 S1(25,J) = S1(25,J) + S1(I*2-1,J)
            S1(26,J) = S1(26,J) + S1(I*2,J)
         53 CONTINUE
            S1(26,J) = S1(26,J) / 12.0
            IF(J.GT.5) S1(26,J) = S1(26,J) * 2.0
         54 CONTINUE
            DO 56 J=1,5
            S2(25,J) = 0
            S2(26,J) = 0
            DO 55 I=1,12
            S2(25,J) = S2(25,J) + S2(I*2-1,J)
         55 S2(26,J) = S2(26,J) + S2(I*2,J)
         56 S2(26,J) = S2(26,J) / 12.0
            DO 58 J=1,24
            S3(13,J) = 0.0
            DO 57 I=1,12
         57 S3(13,J) = S3(13,J) + S3(I,J)
         58 S3(13,J) = S3(13,J) / 12.0
            WRITE(6,160) IYEAR, IYEAR
            WRITE(6,161)
      C
      C     WRITE SUMMARY PAGE
      C
            DO 61 I=1,12
            K = I * 2 - 1
            L = K + 1
            IF(I.LT.5.OR.I.GT.10) GO TO 60
            WRITE(6,162) (MONTH(I,J),J=1,3), (S1(K,J),J=1,5),S1(K,8), S2(K,5),
           A             (S1(L,J),J=1,7), (S2(L,J),J=1,3), S1(L,8), S2(L,4),
           B             S2(L,5)
            GOTO 61
         60 WRITE(6,163) (MONTH(I,J),J=1,3), (S1(K,J),J=1,5),S2(K,5),
           A             (S1(L,J),J=1,5), (S2(L,J),J=1,5)
         61 CONTINUE
            WRITE(6,164) (S1(25,J),J=1,5), S1(25,8), S2(25,5),
           A             (S1(26,J),J=1,7), (S2(26,J),J=1,3), S1(26,8),
           B             (S2(26,J),J=4,5)
      C
            WRITE(6,165) IYEAR, IYEAR
            WRITE(6,166)
            WRITE(6,167) ((MONTH(I,J),J=1,3), (S3(I,K),K=1,12), I=1,13)
            WRITE(6,168)
            WRITE(6,167) ((MONTH(I,J),J=1,3), (S3(I,K),K=13,24), I=1,13)
            WRITE(6,169)
            GOTO 1
      C
      C
        999 STOP
        120 FORMAT('0',T23,'PRECIPITATION (MM)',T65,'SOIL MOISTURE',T90,
           A       'RELATIVE',/,T7,'DAY',T90,'HUMIDITY    HRS OF       POT',5X,
           B       'CLOUD',/,T7,'OF       TOTAL    RAIN',3(4X,'SNOW'),T60,
           C       'IRRIGATED',T76,'NON-IRRIG',T102,'98-100        EVAP',4X,
           D       'COVER   WIND',/,' DAY  YEAR',3(4X,'PREC'),'     FALL',4X,
           E       'COVER',5X,'PERCENT DEW IRR*  PERCENT DEW     MAX  MIN',4X,
           F       'REL-HUM     (MM)     (0-10)  (KM)',//)
```

```
0147      121 FORMAT('-TOTALS    ',5F8.1,F11.1,2I4,F10.1,I4,T109,F8.1,7X,I8)
0148      122 FORMAT('0MEANS     ',5F8.1,F11.1,T73,F8.1,T88,2I5,I8,F11.1,I7,I8,/,
             A        '0EXTREMES ',/,
             B        '          HIGH',5F8.1,F11.1,T73,F8.1,T88,2I5,I8,F11.1,I7,I8,/,
             C        '          LOW ',5F8.1,F11.1,T73,F8.1,T88,2I5,I8,F11.1,I7,I8,/,
             D        '-* DATE OF IRRIGATION (MAY THROUGH OCTOBER)')
0149      123 FORMAT('-TOTALS    ',5F8.1,T124,I8)
0150      124 FORMAT('0MEANS     ',5F8.1,T88,2I5,I8,11X,I7,I8,/,'0EXTREMES',/,
             A        '          HIGH',5F8.1,T88,2I5,I8,11X,I7,I8,/,
             B        '          LOW ',5F8.1,T88,2I5,I8,11X,I7,I8,/,'-* DATE OF ',
             C        'IRRIGATION (MAY THROUGH OCTOBER)')
0151      130 FORMAT(31X,'WEATHER SHELTER TEMPERATURES',        32X,'5 CM BENE
             AATH SOIL SURFACE',//,9X,'DAY',13X,'THERMOMETER',16X,'HYGROTHERMOGR
             BAPH',16X,'IRRIGATED',18X,'NON-IRRIGATED',/,9X,'OF',/,5X,
             C 'DAY YEAR',4(8X,'MAX.    MIN.    MEAN '),/)
0152      131 FORMAT        (5X,A2,2X,A3,4(5X,3F8.1))
0153      132 FORMAT('-    MEANS  ',4(5X,3F8.1),/,'0    EXTREMES',/,
             A        8X,'HIGH',4(5X,2F8.1,4X,A4),/,8X,'LOW ',4(5X,2F8.1,4X,A4),
             B        /,'-     ALL TEMPERATURES IN DEGREES CELSIUS')
0154      140 FORMAT(16X,'WEATHER SHELTER',15X,'SOIL SURFACE UNDER GRASS COVER',
             A  27X,'BARE SOIL SURFACE',//,5X,'DAY',10X,'THERMOMETER',4X,
             B  2(11X,'IRRIGATED',14X,'NON-IRRIGATED',3X),/,5X,'OF',/,
             C ' DAY YEAR',6X,'MAX.   MIN.   MEAN',4(7X,'MAX.   MIN.   MEAN'),/)
0155      141 FORMAT        (1X,A2,2X,A3,5(4X,3F7.1))
0156      142 FORMAT('-MEANS  ',5(4X,3F7.1),/,'0EXTREMES',/,'     HIGH',
             A        5(4X,2F7.1,3X,A4),/,'     LOW ',5(4X,2F7.1,3X,A4),/,
             B        '-ALL TEMPERATURES IN DEGREES CELSIUS')
0157      160 FORMAT('1  ',I4,' SUMMARY - PRECIPITATION',95X,'PART 1',///,51X,
             A  I4,' SUMMARY OF METEOROLOGIC DATA',/,55X,'BYU PARASITOLOGY STATI
             BON',/,61X,'PROVO, UTAH',//)
0158      161 FORMAT(32X,'PRECIPITATION (MM)',T66,'SOIL MOISTURE',T84,
             A        'RELATIVE',/,T68,'(PERCENT)',T84,'HUMIDITY',T97,
             B        'HRS OF   POT    CLOUD',/,24X,'TOTAL   RAIN',
             C        3('    SNOW'),T97,'98-100   EVAP   COVER   WIND',/,3X,
             D        'MONTH',16X,3('PREC    '),'FALL    COVER    IRRG  ',
             E        'NON-IRRG   MAX    MIN    REL HUM  (MM)   (0-10)  (KM)')
0159      162 FORMAT('0  ',3A4,'TOTAL',5F8.1,5(6X,'--'),F8.1,6X,'--',I8,/,
             A        15X,'MEAN ',7F8.1,3I8,F8.1,2I8)
0160      163 FORMAT('0  ',3A4,'TOTAL',5F8.1,5(6X,'--'),6X,'ND',6X,'--',I8,/,
             A        15X,'MEAN ',5F8.1,2(6X,'ND'),3I8,6X,'ND',2I8)
0161      164 FORMAT('-  YEARLY TOTAL      ',5F8.1,5(6X,'--'), F8.1,'*',5X,'--',
             A        I8,/,'0  GRAND MEAN       ',5F8.1,1X,2(F7.1,'*'),I7,2I8,
             B        F8.1,'*',I7,I8,/,'-  ND = NOT DETERMINED',/,'   * CALCULATE
             CD 1 MAY THROUGH 31 OCTOBER ONLY')
0162      165 FORMAT('1  ',I4,' SUMMARY - TEMPERATURES',95X,'PART 2',///,51X,
             A I4,' SUMMARY OF METEOROLOGIC DATA',/,55X,'BYU PARASITOLOGY STATIO
             BN',/,61X,'PROVO, UTAH',//)
0163      166 FORMAT(34X,'WEATHER SHELTER TEMPERATURES',        32X,'5 CM BENE
             AATH SOIL SURFACE',//,28X,'THERMOMETER',16X,'HYGROTHERMOGRAPH',16X,
             B'IRRIGATED',18X,'NON-IRRIGATED',/,'0  MONTH',8X,4(8X,'MAX.    MIN.
             C     MEAN '),/)
0164      167 FORMAT        (12('   ',3A4,4(5X,3F8.1)/),'0  ',3A4,4(5X,3F8.1),//)
0165      168 FORMAT('-',32X,'SOIL SURFACE UNDER GRASS COVER',34X,'BARE SOIL SUR
             AFACE',//,11X,2(18X,'IRRIGATED',18X,'NON-IRRIGATED'),/,'0  MONTH',
             B   7X,4(9X,'MAX.    MIN.    MEAN'),/)
0166      169 FORMAT('-  ALL TEMPERATURES IN DEGREES CELSIUS',/,'1')
0167      200 FORMAT(20I4)
0168      201 FORMAT(A2,A3,F3.2,4F3.1,2A1,2F3.1,A1,2I3,I2,F3.1,I2,I3,
             A        /,5X,16F3.0)
0169          END


0001          SUBROUTINE HEAD (IYEAR,M,IPG,MONTH)
        C
        C     WRITE A HEADING AND PAGE NUMBER FOR EACH MONTH
        C
0002          INTEGER  NDAYS, DAY, DYR, DEW1, IRRG, DEW2, HHUM, LHUM, THRS,
             A         CLCV, WIND, LINE(10), LIN1(2), LIN2(2), MONTH(13,3)
0003          REAL     TPRE, RAIN, PRSN, SNOW, SNCV, MOSI, MOSN, PEVP
0004          COMMON   NDAYS, DAY(31), DYR(31), TPRE(35), RAIN(35), PRSN(35),
             A         SNOW(35), SNCV(35), MOSI(35), DEW1(32), IRRG(32),
             B         MOSN(35), DEW2(32), HHUM(35), LHUM(35), THRS(35),
             C         PEVP(35), CLCV(35), WIND(35)
```

```
0005        WRITE(6,100) (MONTH(M,I),I=1,3), IYEAR, IPG, (MONTH(M,I),I=1,3),
           A             IYEAR
0006        RETURN
      C
0007        ENTRY PRINTL (I,II)
      C
      C     PRINTL FORMATS DAILY DATA FOR PRINTING
      C     INCLUDES SCALING AND SUPPRESSING ZERO RESULTS
      C
0008        CALL ALPHA (TPRE(I), LINE(1), 25.4)
0009        CALL ALPHA (RAIN(I), LINE(3), 25.4)
0010        CALL ALPHA (PRSN(I), LINE(5), 25.4)
0011        CALL ALPHA (SNOW(I), LINE(7), 25.4)
0012        CALL ALPHA (SNCV(I), LINE(9), 25.4)
0013        CALL ALPHA (MOSI(I), LIN1(1), 1.0)
0014        CALL ALPHA (MOSN(I), LIN2(1), 1.0)
0015        IF(II.LT.5.OR.II.GT.10) GOTO 2
0016        WRITE(6,101) DAY(I), DYR(I), LINE, LIN1, DEW1(I), IRRG(I),
           A             LIN2, DEW2(I), HHUM(I), LHUM(I), THRS(I), PEVP(I),
           B             CLCV(I), WIND(I)
0017        RETURN
0018      2 WRITE(6,102) DAY(I), DYR(I), LINE, HHUM(I), LHUM(I), THRS(I),
           A             CLCV(I), WIND(I)
0019        RETURN
      C
0020    100 FORMAT('1    ',2A4,A2,I4,108X,'PAGE ',I1,///,49X,'MONTHLY SUMMARY O
           AF METEOROLOGIC DATA',/,55X,'BYU PARASITOLOGY STATION',/,61X,
           B'PROVO, UTAH',//,60X,2A4,A2,I4,/)
0021    101 FORMAT(1X,A2,3X,A4,5(2X,A4,A2),6X,A4,A2,2(3X,A1),4X,A4,A2,3X,A1,
           A       3X,2I5,I8,F11.1,I7,I8)
0022    102 FORMAT(1X,A2,3X,A4,5(2X,A4,A2),T88,2I5,I8,T117,I7,I8)
0023        END


0001        SUBROUTINE ALPHA (R,C,S)
      C
      C     CONVERT R SCALED BY S INTO ALPHA CHARACTERS AND RETURN IN C.
      C     (RETURNS BLANK CHARACTERS IF ZERO)
      C
0002        INTEGER N1(301) /'   0','   1','   2','   3','   4','   5','   6',
           A   '   7','   8','   9','  10','  11','  12','  13','  14','  15',
           B   '  16','  17','  18','  19','  20','  21','  22','  23','  24',
           C   '  25','  26','  27','  28','  29','  30','  31','  32','  33',
           D   '  34','  35','  36','  37','  38','  39','  40','  41','  42',
           E   '  43','  44','  45','  46','  47','  48','  49','  50','  51',
           F   '  52','  53','  54','  55','  56','  57','  58','  59','  60',
           G   '  61','  62','  63','  64','  65','  66','  67','  68','  69',
           H   '  70','  71','  72','  73','  74','  75','  76','  77','  78',
           I   '  79','  80','  81','  82','  83','  84','  85','  86','  87',
           J   '  88','  89','  90','  91','  92','  93','  94','  95','  96',
           K   '  97','  98','  99',' 100',' 101',' 102',' 103',' 104',' 105',
           L   ' 106',' 107',' 108',' 109',' 110',' 111',' 112',' 113',' 114',
           M   ' 115',' 116',' 117',' 118',' 119',' 120',' 121',' 122',' 123',
           N   ' 124',' 125',' 126',' 127',' 128',' 129',' 130',' 131',' 132',
           O   ' 133',' 134',' 135',' 136',' 137',' 138',' 139',' 140',' 141',
           P   ' 142',' 143',' 144',' 145',' 146',' 147',' 148',' 149',' 150'/
0003        INTEGER N3(275) /' 151',' 152',' 153',' 154',' 155',' 156',' 157',
           A   ' 158',' 159',' 160',' 161',' 162',' 163',' 164',' 165',' 166',
           B   ' 167',' 168',' 169',' 170',' 171',' 172',' 173',' 174',' 175',
           C   ' 176',' 177',' 178',' 179',' 180',' 181',' 182',' 183',' 184',
           D   ' 185',' 186',' 187',' 188',' 189',' 190',' 191',' 192',' 193',
           E   ' 194',' 195',' 196',' 197',' 198',' 199',' 200',' 201',' 202',
           F   ' 203',' 204',' 205',' 206',' 207',' 208',' 209',' 210',' 211',
           G   ' 212',' 213',' 214',' 215',' 216',' 217',' 218',' 219',' 220',
           H   ' 221',' 222',' 223',' 224',' 225',' 226',' 227',' 228',' 229',
           I   ' 230',' 231',' 232',' 233',' 234',' 235',' 236',' 237',' 238',
           J   ' 239',' 240',' 241',' 242',' 243',' 244',' 245',' 246',' 247',
           K   ' 248',' 249',' 250',' 251',' 252',' 253',' 254',' 255',' 256',
           L   ' 257',' 258',' 259',' 260',' 261',' 262',' 263',' 264',' 265',
           M   ' 266',' 267',' 268',' 269',' 270',' 271',' 272',' 273',' 274'/
0004        EQUIVALENCE (N1(152),N3(1))
0005        INTEGER N2(11)  /'.0','.1','.2','.3','.4','.5','.6','.7','.8',
           A                '.9'/, BLANK/'    '/ , C(2)
0006        R = R * S
0007        C(1) = BLANK
```

```
      C(2) = BLANK
      R1 = R + 0.05
      I1 = R1
      I2 = (R1 - I1) * 10
      IF(I1.EQ.0.AND.I2.EQ.0) RETURN
      C(1) = N1(I1+1)
      C(2) = N2(I2+1)
      RETURN
      END


      SUBROUTINE CALC (X,N)
C
C     CALC PROCESSES REAL DATA IN X AND RETURNS SUMS IN ROW 32,
C     MEANS IN ROW 33, MINIMUMS IN ROW 34, AND MAXIMUMS IN ROW 35.
C
      REAL X(34,N), S(35)
      REAL BLANK/'    '/
      LOGICAL ZERO
      COMMON NDAYS
      DO 10 J=1,N
      X(32,J) = 0.0
      X(33,J) = -100.0
      X(34,J) = 1000.0
      DO 10 I=1,NDAYS
      IF(MOD(J,3).NE.0) GO TO 9
      X(I,J) = (X(I,J-2) + X(I,J-1)) / 2.0
      X(32,J) = X(32,J) + X(I,J)
      GO TO 10
    9 X(32,J) = X(32,J) + X(I,J)
      IF(X(33,J).LT.X(I,J)) X(33,J) = X(I,J)
      IF(X(34,J).GT.X(I,J)) X(34,J) = X(I,J)
   10 CONTINUE
      DO 11 J=1,N
      X(32,J) = X(32,J) / NDAYS
      IF(MOD(J,3).NE.0) GO TO 11
      X(33,J) = BLANK
      X(34,J) = BLANK
   11 CONTINUE
      RETURN
C
      ENTRY SUMR (S)
C
C     PROCESS REAL DATA IN ARRAY S AND RETURN SUM IN S(32), MEAN IN
C     S(33), MINIMUM IN S(34), AND MAXIMUM IN S(35).
C
      ZERO = .FALSE.
    1 S(32) = 0.0
      S(33) = 0.0
      S(34) = -1000.0
      S(35) = 1000.0
      N = 0
      DO 2 I=1,NDAYS
      IF(ZERO.AND.S(I).LT.0.001) GOTO 2
      N = N + 1
      S(32) = S(32) + S(I)
      IF(S(34).LT.S(I)) S(34) = S(I)
      IF(S(35).GT.S(I)) S(35) = S(I)
    2 CONTINUE
      IF(N.EQ.0) RETURN
      S(33) = S(32) / N
      RETURN
C
      ENTRY SUMZ (S)
      ZERO = .TRUE.
      GOTO 1
      END


      SUBROUTINE SUMI (IY)
C
C     PROCESS INTEGER DATA IN ARRAY IY AND RETURN SUM IN IY(32),
C     MEAN IN IY(33), MINIMUM IN IY(34), AND MAXIMUM IN IY(35).
C
      INTEGER IY(35), PLUS/'+'/
```

```
0003          COMMON NDAYS
0004          IY(32) = 0
0005          IY(34) = 0
0006          IY(35) = 1000
0007          DO 13 I=1,NDAYS
0008          IY(32) = IY(32) + IY(I)
0009          IF(IY(34).LT.IY(I)) IY(34) = IY(I)
0010          IF(IY(35).GT.IY(I)) IY(35) = IY(I)
0011       13 CONTINUE
0012          IY(33) = IY(32) / NDAYS + 0.5
0013          RETURN
        C
        C
0014          ENTRY SUMC (IY)
        C
        C     PROCESS CHARACTER DATA IN ARRAY IY AND RETURN THE NUMBER OF '+'
        C     IN IY(32).
        C
0015          IY(32) = 0
0016          DO 14 I=1,NDAYS
0017          IF(IY(I).EQ.PLUS) IY(32) = IY(32) + 1
0018       14 CONTINUE
0019          RETURN
0020          END


        C     ***********************************************************************
        C     *                                                                     *
        C     *      WEATHER DATA ANALYSIS, PART II                                 *
        C     *                                                                     *
        C     *      PROGRAMMED BY PAUL ROSS ROPER                                  O
        C     *                    EYRING RESEARCH INSTITUTE, 1974                  *
        C     *                                                                     *
        C     ***********************************************************************
        C
        C
        C
        C     DECK FORMAT        CONTROL CARD
        C                        DATA HEADER     (ON TAPE IF DESIRED)
        C                        DATA            (ON TAPE IF DESIRED)
        C
        C                        COLUMNS    DESCRIPTION
        C     1. CONTROL CARD    1-4        YEAR
        C                        5-8        DESIRED GRAPH BY NUMBER
        C                        9-12 ...   13 GRAPHS POSSIBLE
        C
        C     2. DATA HEADER     1-4        YEAR OF DATA
        C                        5-8        NUMBER OF DAYS IN YEAR
        C                        9-12       LAST WIND READING OF PREVIOUS YEAR
        C
        C     3. DATA            SEE PUBLICATION FOR CARD COLUMNS AND DATA
        C                        DESCRIPTION.
        C
0001          COMMON /PLOTO /  XPLT(366), ITAPE
             A       /PLOT1 /  RAIN(366), XIRR(366), YIRR(366), YNIR(366)
             B       /PLOT2 /  SNOW(366)
             C       /PLOT3 /  YHHD(366), YLHD(366)
             D       /PLOT4 /  HUMD(366)
             E       /PLOT5 /  EVAP(366)
             F       /PLOT6 /  WIND(366)
             G       /PLOT7 /  YMAX(366), YMIN(366)
             H       /PLOT8 /  YH5C(366), YL5C(366), ZH5C(366), ZL5C(366)
             I       /PLOT9 /  YHA1(366), YLA1(366)
             J       /PLOT10/  YHSS(366), YLSS(366), ZHSS(366), ZLSS(366)
             K       /PLOT11/  YHA2(366), YLA2(366)
             L       /PLOT12/  YHBG(366), YLBG(366), ZHBG(366), ZLBG(366)
             M       /PLOT13/  YHA3(366), YLA3(366)
0002          COMMON /LABELS/  AX1(37), AY1(37), AX2(73), AY2(73),
             A                 BX(4),   BY(4),   XL(4),   YL(4),
             B                 RC1(7),  LC1(7),  RC2(13), LC2(13),
             C                 RC3(11), LC3(11), RC4(13), LC4(13),
             D                 RC5(11), LC5(18), RC6(8),  LC6(16),
             E                 RC7(12), LC7(24)
        C
        C     CREATE A DEGREE SYMBOL
```

```
          DIMENSION         DEG(3), O(3), NGRAPH(14)
          DATA    DEG       /Z05061727, Z36352414, Z05061727/, J /Z91/
          DATA    O         /Z01061737, Z46413010, Z01061737/, K /Z06/
          CALL SYMBL5 (J,9,DEG)
          CALL SYMBL5 (K,9,O)
          REWIND ITAPE
C
C         READ CONTROL CARD
C
      100 READ(5,200,END=999) NYEAR, NGRAPH
      200 FORMAT(15I4)
          NUM = 0
C
C         READ ONE YEAR'S DATA
C
          CALL READC (NYEAR,NDAYS)
C
C         CONTROL LOOP
C
      300 NUM = NUM + 1
          M = NGRAPH(NUM)
          GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13), M
          GO TO 100
      999 CALL PLOT   (12.0,0.0,-3)
          STOP
C
C
C*****************PLOT   1**************************************************
C                      PRECIPITATION AND SOIL MOISTURE
C
C
        1 CALL AXES   (3.0,RC1,4,0.5,7,1,LC1,4,0.5,7,1)
          CALL SCALE  (RAIN,NDAYS,3.00,  3.0,  0.0, 2)
          CALL SYMBL4 (-0.24,1.2,0.07,'MILLIMETERS',90.0,11)
          CALL SYMBL4 (0.2,2.8,0.1,'PRECIPITATION',0.0,13)
          CALL SYMBL4 (1.39,2.8,0.07,'AND',0.0,3)
          CALL SYMBL4 (1.64,2.8,0.1,'SOIL MOISTURE',0.0,13)
          CALL DATE   (NYEAR,0.2,2.65)
          CALL BAR    (XPLT,RAIN,NDAYS)
          CALL SYMBL4 (8.21,1.3,0.07,'INCHES',90.0,6)
          CALL MOIST
          GO TO 300
C
C
C*****************PLOT   2**************************************************
C                      SNOW COVER
C
C
        2 CALL AXES   (3.0,RC2,4,0.25,13,1,LC2,4,0.25,13,1)
          CALL SCALE  (SNOW,NDAYS,3.00, 12.0,  0.0, 3)
          CALL SYMBL4 (-0.27,1.2,0.07,'MILLIMETERS',90.0,11)
          CALL SYMBL4 (0.2,2.8,0.1,'SNOW COVER',0.0,10)
          CALL DATE   (NYEAR,0.2,2.65)
          CALL BAR    (XPLT,SNOW,NDAYS)
          CALL SYMBL4 (8.23,1.3,0.07,'INCHES',90.0,6)
          GO TO 300
C
C
C*****************PLOT   3**************************************************
C                      RELATIVE HUMIDITY IN WEATHER SHELTER
C
C
        3 CALL AXES   (3.0,RC3,4,0.25,11,1,LC3,4,0.25,11,1)
          CALL SCALE  (YHHL,NDAYS,2.49,100.0,  0.0, 4)
          CALL SCALE  (YLHD,NDAYS,2.49,100.0,  0.0, 5)
          CALL SYMBL4 (-0.25,1.1,0.07,'PERCENT',90.0,7)
          CALL SYMBL4 (0.2,2.8,0.1,'RELATIVE HUMIDITY IN WEATHER SHELTER',
         A                    0.0,36)
          CALL DATE   (NYEAR,0.2,2.65)
          CALL LEGEND (1,7.0,2.8)
          CALL LINES  (XPLT,YHHD,NDAYS,0.01,2)
          CALL DASH   (XPLT,YLHD,NDAYS,0.03)
          CALL SYMBL4 (8.25,1.1,0.07,'PERCENT',90.0,7)
          GO TO 300
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```
C*****************PLOT   4*********************************************
C                      DAILY DURATION OF RELATIVE HUMIDITY
C
C
     4 CALL AXES    (3.0,RC4,4,0.21,13,1,LC4,4,0.21,13,1)
       CALL SCALE   (HUMD,NDAYS,2.49, 24.0,  0.0, 6)
       CALL SYMBL4  (-0.22,1.5,0.07,'HOURS',90.0,5)
       CALL SYMBL4  (0.2,2.8,0.1,'DAILY DURATION OF RELATIVE HUMIDITY AT 9
      A8-100(',      0.0,46)
       CALL DATE    (NYEAR,0.2,2.65)
       CALL BAR     (XPLT,HUMD,NDAYS)
       CALL SYMBL4  (8.23,1.5,0.07,'HOURS',90.0,5)
       GO TO 300
C
C
C*****************PLOT   5*********************************************
C                      POTENTIAL EVAPORATION
     5 CALL AXES    (3.0,RC5,4,0.28,11,1,LC5,5,0.35,18,2)
       CALL SCALE   (EVAP,NDAYS,3.00, 20.0,  0.0, 7)
       CALL SYMBL4  (-0.23,1.2,0.07,'MILLIMETERS',90.0,11)
       CALL SYMBL4  (0.2,2.8,0.1,'POTENTIAL EVAPORATION',0.0,21)
       CALL DATE    (NYEAR,0.2,2.65)
       CALL SYMBL4  (2.0,0.5,0.07,'STARTED',0.0,7)
       J = NDAYS - 244
       CALL LINES   (XPLT(J),EVAP(J),184,0.01,2)
       CALL SYMBL4  (7.0,0.5,0.07,'STOPPED',0.0,7)
       CALL SYMBL4  (8.30,1.3,0.07,'INCHES',90.0,6)
       GO TO 300
C
C
C*****************PLOT   6*********************************************
C                      TOTAL WIND 1 METER ABOVE GROUND
C
C
     6 CALL AXES    (3.0,RC6,4,0.42,8,1,LC6,5,0.42,16,2)
       CALL SCALE   (WIND,NDAYS,2.94,175.0,  0.0, 8)
       CALL SYMBL4  (-0.29,1.2,0.07,'KILOMETERS',90.0,10)
       CALL SYMBL4  (0.2,2.8,0.1,'TOTAL WIND 1 METER ABOVE GROUND',0.0,31)
       CALL DATE    (NYEAR,0.2,2.65)
       CALL LINES   (XPLT,WIND,NDAYS,0.01,2)
       CALL SYMBL4  (8.3,1.4,0.07,'MILES',90.0,5)
       GO TO 300
C
C
C*****************PLOT   7*********************************************
C                      TEMPERATURE IN WEATHER SHELTER
C
C
     7 CALL AXES    (4.0,RC7(1),4,0.5,9,1,LC7(1),5,0.5,18,2)
       CALL SCALE   (YMAX,NDAYS,4.00,122.0,-22.0, 9)
       CALL SCALE   (YMIN,NDAYS,4.00,122.0,-22.0,10)
       CALL SYMBL4  (-0.25,1.2,0.07,'TEMPERATURE (JC)',90.0,16)
       CALL SYMBL4  (0.2,3.7,0.1,'TEMPERATURE IN WEATHER SHELTER',0.0,30)
       CALL DATE    (NYEAR,0.2,3.55)
       CALL LEGEND  (1,7.0,3.7)
       CALL ZERO    (1.5)
       CALL SYMBL4  (8.32,1.2,0.07,'TEMPERATURE (JF)',90.0,16)
       CALL LINES   (XPLT,YMAX,NDAYS,0.01,2)
       CALL DASH    (XPLT,YMIN,NDAYS,0.02)
       GO TO 300
C
C
C*****************PLOT   8*********************************************
C                      COMPARISON OF MAX AND MIN TEMP 5 CM UNDER 10 CM GRASS
C
C
     8 CALL AXES    (3.0,RC7(3),4,0.6,6,1,LC7(5),5,0.6,12,2)
       CALL SCALE   (YH5C,NDAYS,3.00, 40.0,-10.0,11)
       CALL SCALE   (YL5C,NDAYS,3.00, 40.0,-10.0,12)
       CALL SCALE   (ZH5C,NDAYS,3.00, 40.0,-10.0,13)
       CALL SCALE   (ZL5C,NDAYS,3.00, 40.0,-10.0,14)
       CALL SYMBL4  (-0.25,1.0,0.07,'TEMPERATURE (JC)',90.0,16)
       CALL SYMBL4  (0.2,2.8,0.1,'COMPARISON OF MAXIMUM AND MINIMUM TEMPER
      AATURES',      0.0,46)
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0095        CALL SYMBL4 (0.2,2.7,0.07,'5 CM DEEP IN SOIL UNDER 10 CM GRASS COV
           AER',        0.0,41)
0096        CALL SYMBL4 (0.2,2.6,0.07,'ON IRRIGATED AND NON-IRRIGATED PLOTS',
           A            0.0,36)
0097        CALL DATE   (NYEAR,0.2,2.45)
0098        CALL LEGEND (2,6.75,2.8)
0099        CALL ZERO   (0.6)
0100        CALL SYMBL4 (8.32,1.0,0.07,'TEMPERATURE (JF)',90.0,16)
0101        CALL LINES  (XPLT,YH5C,NDAYS,0.01,3)
0102        CALL LINE   (XPLT,YL5C,NDAYS,1)
0103        CALL DASH   (XPLT,ZH5C,NDAYS,0.04)
0104        CALL DASH   (XPLT,ZL5C,NDAYS,0.02)
0105        GO TO 300
     C
     C
     C*****************PLOT  9*********************************************
     C                    COMPARISCN OF MEANS 5 CM UNDER 10 CM GRASS
     C
0106      9 CALL AXES   (3.0,RC7(3),4,0.6,6,1,LC7(5),5,0.6,12,2)
0107        CALL SCALE  (YHA1,NDAYS,3.00, 40.0,-10.0,15)
0108        CALL SCALE  (YLA1,NDAYS,3.00, 40.0,-10.0,16)
0109        CALL SYMBL4 (-0.25,1.0,0.07,'TEMPERATURE (JC)',90.0,16)
0110        CALL SYMBL4 (0.2,2.8,0.1,'CCMPARISON OF DAILY MEAN TEMPERATURES',
           A            0.0,37)
0111        CALL SYMBL4 (0.2,2.7,0.07,'5 CM DEEP IN SOIL UNDER 10 CM GRASS COV
           AER',        0.0,41)
0112        CALL SYMBL4 (0.2,2.6,0.07,'ON IRRIGATED AND NON-IRRIGATED PLOTS',
           A            0.0,36)
0113        CALL DATE   (NYEAR,0.2,2.45)
0114        CALL LEGEND (3,6.5,2.8)
0115        CALL ZERO   (0.6)
0116        CALL LINES  (XPLT,YHA1,NDAYS,0.01,2)
0117        CALL DASH   (XPLT,YLA1,NDAYS,0.02)
0118        CALL SYMBL4 (8.32,1.0,0.07,'TEMPERATURE (JF)',90.0,16)
0119        GO TO 300
     C
     C
     C*****************PLOT 10*********************************************
     C                    COMPARISON OF MAX AND MIN TEMP AT SOIL SURFACE
     C
0120     10 CALL AXES   (3.5,RC7(3),4,0.5,8,1,LC7(5),5,0.5,16,2)
0121        CALL SCALE  (YHSS,NDAYS,3.50, 60.0,-10.0,17)
0122        CALL SCALE  (YLSS,NDAYS,3.50, 60.0,-10.0,18)
0123        CALL SCALE  (ZHSS,NDAYS,3.50, 60.0,-10.0,19)
0124        CALL SCALE  (ZLSS,NDAYS,3.50, 60.0,-10.0,20)
0125        CALL SYMBL4 (-0.25,1.3,0.07,'TEMPERATURE (JC)',90.0,16)
0126        CALL SYMBL4 (0.2,3.3,0.1,'COMPARISON OF MAXIMUM AND MINIMUM TEMPER
           AATURES',    0.0,46)
0127        CALL SYMBL4 (0.2,3.2,0.07,'AT SOIL SURFACE UNDER 10 CM GRASS COVER
           A',          0.0,39)
0128        CALL SYMBL4 (0.2,3.1,0.07,'ON IRRIGATED AND NON-IRRIGATED PLOTS',
           A            0.0,36)
0129        CALL DATE   (NYEAR,0.2,2.95)
0130        CALL LEGEND (2,6.75,3.3)
0131        CALL ZERO   (0.5)
0132        CALL SYMBL4 (8.32,1.3,0.07,'TEMPERATURE (JF)',90.0,16)
0133        CALL LINES  (XPLT,YHSS,NDAYS,0.01,3)
0134        CALL LINE   (XPLT,YLSS,NDAYS,1)
0135        CALL DASH   (XPLT,ZHSS,NDAYS,0.04)
0136        CALL DASH   (XPLT,ZLSS,NDAYS,0.02)
0137        GO TO 300
     C
     C
     C*****************PLOT 11*********************************************
     C                    COMPARISON OF MEANS AT SOIL SURFACE
     C
     C
0138     11 CALL AXES   (3.0,RC7(3),4,0.5,7,1,LC7(5),5,0.5,14,2)
0139        CALL SCALE  (YHA2,NDAYS,3.00, 50.0,-10.0,21)
0140        CALL SCALE  (YLA2,NDAYS,3.00, 50.0,-10.0,22)
0141        CALL SYMBL4 (-0.25,1.0,0.07,'TEMPERATURE (JC)',90.0,16)
0142        CALL SYMBL4 (0.2,2.8,0.1,'CCMPARISON OF DAILY MEAN TEMPERATURES',
           A            0.0,37)
0143        CALL SYMBL4 (0.2,2.7,0.07,'AT SOIL SURFACE UNDER 10 CM GRASS',
           A            0.0,33)
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      CALL SYMBL4 (0.2,2.6,0.07,'ON IRRIGATED AND NON-IRRIGATED PLOTS',
     A            0.0,36)
      CALL DATE   (NYEAR,0.2,2.45)
      CALL LEGEND (3,6.5,2.8)
      CALL ZERO   (0.5)
      CALL SYMBL4 (8.32,1.0,0.07,'TEMPERATURE (JF)',90.0,16)
      CALL LINES  (XPLT,YHA2,NDAYS,0.01,2)
      CALL DASH   (XPLT,YLA2,NDAYS,0.02)
      GO TO 300
C
C
C*****************PLOT 12*********************************************
C                      COMPARISON OF MAX AND MIN ON BARE GROUND
C
C
   12 CALL AXES   (5.0,PC7(2),4,0.5,11,1,LC7(3),5,0.5,22,2)
      CALL SCALE  (YHBG,NDAYS,5.00, 80.0,-20.0,23)
      CALL SCALE  (YLBG,NDAYS,5.00, 80.0,-20.0,24)
      CALL SCALE  (ZHBG,NDAYS,5.00, 80.0,-20.0,25)
      CALL SCALE  (ZLBG,NDAYS,5.00, 80.0,-20.0,26)
      CALL SYMBL4 (-0.25,2.0,0.07,'TEMPERATURE (JC)',90.0,16)
      CALL SYMBL4 (0.2,4.8,0.1,'COMPARISON OF MAXIMUM AND MINIMUM TEMPER
     AATURES',    0.0,46)
      CALL SYMBL4 (0.2,4.66,0.08,'AT SOIL SURFACE ON BARE GROUND ON',
     A            0.0,33)
      CALL SYMBL4 (0.2,4.52,0.08,'IRRIGATED AND NON-IRRIGATED PLOTS',
     A            0.0,33)
      CALL DATE   (NYEAR,0.2,4.37)
      CALL LEGEND (2,6.75,4.8)
      CALL ZERO   (1.0)
      CALL SYMBL4 (8.32,2.0,0.07,'TEMPERATURE (JF)',90.0,16)
      CALL LINES  (XPLT,YHBG,NDAYS,0.01,3)
      CALL LINE   (XPLT,YLBG,NDAYS,1)
      CALL DASH   (XPLT,ZHBG,NDAYS,0.04)
      CALL DASH   (XPLT,ZLBG,NDAYS,0.02)
      GO TO 300
C
C
C*****************PLOT 13*********************************************
C                      COMPARISON OF MEANS OF BARE GROUND
C
C
   13 CALL AXES   (3.0,PC7(3),4,0.5,7,1,LC7(5),5,0.5,14,2)
      CALL SCALE  (YHA3,NDAYS,3.00, 50.0,-10.0,27)
      CALL SCALE  (YLA3,NDAYS,3.00, 50.0,-10.0,28)
      CALL SYMBL4 (-0.25,1.0,0.07,'TEMPERATURE (JC)',90.0,16)
      CALL SYMBL4 (0.2,2.8,0.1,'COMPARISON OF DAILY MEAN TEMPERATURES',
     A            0.0,37)
      CALL SYMBL4 (0.2,2.7,0.07,'ON BARE GROUND ON IRRIGATED',0.0,27)
      CALL SYMBL4 (0.2,2.6,0.07,'AND NON-IRRIGATED PLOTS',0.0,23)
      CALL DATE   (NYEAR,0.2,2.45)
      CALL LEGEND (3,6.5,2.8)
      CALL ZERO   (0.5)
      CALL SYMBL4 (8.32,1.0,0.07,'TEMPERATURE (JF)',90.0,16)
      CALL LINES  (XPLT,YHA3,NDAYS,0.01,2)
      CALL DASH   (XPLT,YLA3,NDAYS,0.03)
      GO TO 300
      END

      BLOCK DATA
      COMMON /PLOTO /  XPLT(366), ITAPE
     A       /PLOT1 /  RAIN(366), XIRR(366), YIRR(366), YNIR(366)
     B       /PLOT2 /  SNOW(366)
     C       /PLOT3 /  YHHD(366), YLHD(366)
     D       /PLOT4 /  HUMD(366)
     E       /PLOT5 /  EVAP(366)
     F       /PLOT6 /  WIND(366)
     G       /PLOT7 /  YMAX(366), YMIN(366)
     H       /PLOT8 /  YH5C(366), YL5C(366), ZH5C(366), ZL5C(366)
     I       /PLOT9 /  YHA1(366), YLA1(366)
     J       /PLOT10/  YHSS(366), YLSS(366), ZHSS(366), ZLSS(366)
     K       /PLOT11/  YHA2(366), YLA2(366)
     L       /PLOT12/  YHBG(366), YLBG(366), ZHBG(366), ZLBG(366)
     M       /PLOT13/  YHA3(366), YLA3(366)
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0003          COMMON /LABELS/  AX1(37), AY1(37), AX2(73), AY2(73),
             A                 BX(4),    BY(4),    XL(4),    YL(4),
             B                 RC1(7),   LC1(7),   RC2(13), LC2(13),
             C                 RC3(11), LC3(11), RC4(13), LC4(13),
             D                 RC5(11), LC5(18), RC6(8),   LC6(16),
             E                 RC7(12), LC7(24)
        C     TAPE UNIT NUMBER
0004          DATA     ITAPE    /5/
0005          DATA     RC1,LC1  /'  0 ', '   -', ' 25-', '   -', ' 50-', '   -',
             A                   ' 75-', '  0 ', '-   ', '- 1 ', '-   ', '- 2 ',
             B                   '-   ', '  3 '/
0006          DATA     RC2,LC2  /'  0 ', ' 25-', ' 50-', ' 75-', '100-', '125-',
             A                   '150-', '175-', '200-', '225-', '250-', '275-',
             B                   '300-', '  0 ', '- 1 ', '- 2 ', '- 3 ', '- 4 ',
             C                   '- 5 ', '- 6 ', '- 7 ', '- 8 ', '- 9 ', '- 10',
             D                   '- 11', '- 12'/
0007          DATA     RC3,LC3  /'  0 ', ' 10-', ' 20-', ' 30-', ' 40-', ' 50-',
             A                   ' 60-', ' 70-', ' 80-', ' 90-', '100-', '  0 ',
             B                   '- 10', '- 20', '- 30', '- 40', '- 50', '- 60',
             C                   '- 70', '- 80', '- 90', '-100'/
0008          DATA     RC4,LC4  /'  0 ', '  2-', '  4-', '  6-', '  8-', ' 10-',
             A                   ' 12-', ' 14-', ' 16-', ' 18-', ' 20-', ' 22-',
             B                   ' 24-', '  0 ', '- 2 ', '- 4 ', '- 6 ', '- 8 ',
             C                   '- 10', '- 12', '- 14', '- 16', '- 18', '- 20',
             D                   '- 22', '- 24'/
0009          DATA     RC5,LC5  /'  0 ', '  2-', '  4-', '  6-', '  8-', ' 10-',
             A                   ' 12-', ' 14-', ' 16-', ' 18-', ' 20-', '  0.',
             B                   '0   ', '- 0.', '1   ', '- 0.', '2   ', '- 0.',
             C                   '3   ', '- 0.', '4   ', '- 0.', '5   ', '- 0.',
             D                   '6   ', '- 0.', '7   ', '- 0.', '8   '/
0010          DATA     RC6,LC6  /'  0 ', ' 40-', ' 80-', '120-', '160-', '200-',
             A                   '240-', '280-', '    ', '0   ', '-  2', '5   ',
             B                   '-  5', '0   ', '-  7', '5   ', '- 10', '0   ',
             C                   '- 12', '5   ', '- 15', '0   ', '- 17', '5   '/
0011          DATA     RC7,LC7  /'-30-', '-20-', '-10-', '  0 ', ' 10-', ' 20-',
             A                   ' 30-', ' 40-', ' 50-', ' 60-', ' 70-', ' 80-',
             B                   '- -2', '2   ', '-  -', '4   ', '-  1', '4   ',
             C                   '-  3', '2   ', '-  5', '0   ', '-  6', '8   ',
             D                   '-  8', '6   ', '- 10', '4   ', '- 12', '2   ',
             E                   '- 14', '0   ', '- 15', '8   ', '- 17', '6   '/
0012          DATA     BX,BY    /2*0.0, 2*7.94, 4*0.0/
0013          DATA     XL,YL    /3.99, 2*0.0, -0.04, 2*0.0, 2*1.34/
0014          DATA     AX1,AY1  /2*7.94,3*7.27,3*6.61,3*5.94,3*5.29,3*4.61,
             A                   3*3.94,3*3.29,3*2.61,3*1.96,3*1.28,3*0.67,2*0.0,
             B                   0.03,2*0.0,0.03,2*0.0,0.03,2*0.0,0.03,2*0.0,
             C                   0.03,2*0.0,0.03,2*0.0,0.03,2*0.0,0.03,2*0.0,
             D                   0.03,2*0.0,0.03,2*0.0,0.03,2*0.0,0.03,2*0.0,
             E                   0.03/
0015          DATA     AX2      /2*7.94,3*7.60,3*7.27,3*6.94,3*6.61,3*6.28,
             A                   3*5.95,3*5.62,3*5.29,3*4.95,3*4.61,3*4.28,
             B                   3*3.94,3*3.62,3*3.29,3*2.95,3*2.61,3*2.29,
             C                   3*1.96,3*1.62,3*1.28,3*0.98,3*0.67,3*0.34,2*0.0/
0016          DATA     AY2      /-0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,
             A                   -0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,
             B                   -0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,
             C                   -0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,
             D                   -0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,
             E                   -0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,-0.03,2*0.0,
             F                   -0.03/
0017          END


0001          SUBROUTINE AXES   (HT,X,NXC,DX,N1,M1,Y,NYC,DY,N2,M2)
        C
        C     GRAPH A BOX OF HEIGHT HT WITH THE MONTHS PLOTTED ALONG THE BOTTOM.
        C     ALSO LABEL THE BOX WITH ARRAY X ON THE RIGHT AND Y ON THE LEFT.
        C     DX IS THE DISTANCE BETWEEN EACH LABLE.  N1 IS THE NUMBER OF LABELS
        C     AND M1 IS THE STEP BETWEEN LABLES.  THE SAME IS TRUE FOR ARRAY Y
        C     WITH DY, N2, AND M2.
        C
0002          DIMENSION X(N1), Y(N2)
0003          COMMON /LABELS/  AX1(37), AY1(37), AX2(73), AY2(73),
             A                 BX(4),    BY(4)
0004          DATA     NCOUNT   /1/
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      IF(NCOUNT.NE.1) GO TO 10
      CALL PLOTS (12.0,0.0,-3)
      CALL PLOT  (2.0,1.0,-3)
      GO TO 11
   10 CALL PLOT   (0.0,6.5,-3)
   11 CALL PLTMRK (-2.0,0.0)
      NCOUNT = NCOUNT + 1
      IF(NCOUNT.EQ.5) NCOUNT = 1
      BY(2) = HT
      BY(3) = HT
      CALL SYMBL4 (0.0,0.03,0.07,'  JANUARY   FEBRUARY     MARCH       A
     APRIL       MAY         JUNE        JULY       AUGUST    SEPTEMBER   OC
     BTOBER   NOVEMBER   DECEMBER',0.0,131)
      CALL LINE (AX1,AY1,37,1)
      CALL PLOT (0.0,0.27,-3)
      CALL SYMBL4 (0.0,-0.11,0.07,'1     15     1     15     1     15     1
     A 15     1     15     1     15     1     15     1     15     1     15     1
     B 15     1     15     1     15',0.0,128)
      CALL LINE (AX2,AY2,73,1)
      CALL LINE (BX,BY,4,1)
      DYY = -0.03
      DO 12 I=1,N2,M2
      CALL SYMBL4 (7.9,DYY,0.07,Y(I),0.0,NYC)
      DYY = DYY + DY
   12 CONTINUE
      DXX = -0.03
      DO 13 I=1,N1,M1
      CALL SYMBL4 (-0.22,DXX,0.07,X(I),0.0,NXC)
      DXX = DXX + DX
   13 CONTINUE
      GO TO 14
C
C     DRAW ZERO LINE AT HEIGHT HT.
C
      ENTRY ZERO (HT)
      BY(2) = HT
      BY(3) = HT
      CALL LINE (BX(2),BY(2),2,1)
   14 RETURN
      END
```

```
      SUBROUTINE DASH (X,Y,N,S)
C
C     SUBROUTINE DASH WILL DRAW DASHED LINES
C
C     X = X ARRAY
C     Y = Y ARRAY
C     N = NUMBER OF POINTS
C     S = LENGTH OF DASHES
C
      DIMENSION X(N), Y(N), A(2), B(2)
      SS = S * 2.0
      DO 30 I=2,N
      DX = X(I) - X(I-1)
      DY = Y(I) - Y(I-1)
      H = SQRT(DX*DX + DY*DY)
      DX = S * DX / H
      DY = S * DY / H
      A(1) = X(I-1)
      B(1) = Y(I-1)
   10 CONTINUE
      IF(H.LE.S) GO TO 20
      A(2) = A(1) + DX
      B(2) = B(1) + DY
      CALL LINE (A,B,2,1)
      IF(H.LE.SS) GO TO 30
      A(1) = A(2) + DX
      B(1) = B(2) + DY
      H = H - SS
      GO TO 10
   20 A(2) = X(I)
      B(2) = Y(I)
      CALL LINE (A,B,2,1)
   30 CONTINUE
```

```
      GO TO 99
C
C     SUBROUTINE LINES WILL MAKE THE LINE DARKER AND WIDER BY DRAWING
C           N NUMBER OF LINES
C
C     X = X ARRAY
C     Y = Y ARRAY
C     N = NUMBER OF POINTS
C     D = DISTANCE BETWEEN LINES
C     M = NUMBER OF LINES
C
      ENTRY LINES (X,Y,N,D,M)
      DY = 0.0
      DO 40 I=1,M
      CALL LINE (X,Y,N,1)
      CALL PLOT (0.0,D,-3)
      DY = DY - D
   40 CONTINUE
      CALL PLOT (0.0,DY,-3)
      GO TO 99
      ENTRY BAR (X,Y,N)
      SS = 0.0
      CALL PLOT (X(1),SS,3)
      DO 50 I=2,N
      CALL PLOT (X(I-1),Y(I),1)
      CALL PLOT (X(I),Y(I),1)
   50 CONTINUE
      CALL PLOT (X(N),SS,1)
   99 RETURN
      END


      SUBROUTINE DATE (NYR,X,Y)
C
C     GRAPH DATE SPECIFIED BY NYR AT POINT (X,Y)
C
      CALL SYMBL4 (X,Y,0.07,'PROVO, UTAH,',0.0,12)
      N = NYR-1969
      GOTO (1,2,3,4,5), N
    1 CALL SYMBL4 (X+0.78,Y,0.07,'1970',0.0,4)
      RETURN
    2 CALL SYMBL4 (X+0.78,Y,0.07,'1971',0.0,4)
      RETURN
    3 CALL SYMBL4 (X+0.78,Y,0.07,'1972',0.0,4)
      RETURN
    4 CALL SYMBL4 (X+0.78,Y,0.07,'1973',0.0,4)
      RETURN
    5 CALL SYMBL4 (X+0.78,Y,0.07,'1974',0.0,4)
      RETURN
C
C
      ENTRY LEGEND (N,X,Y)
C
C     GRAPHS ONE OF FOUR LEGENDS SPECIFIED BY N AT POINT (X,Y)
C
      GOTO (10,11,12,13),N
   10 CALL SYMBL4 (X,Y,0.07,'MAXIMUM',0.0,7)
      CALL SYMBL4 (X,Y-0.1,0.07,'MINIMUM',0.0,7)
      RETURN
   11 CALL SYMBL4 (X,Y,0.07,'MAX NON-IRR',0.0,11)
      CALL SYMBL4 (X,Y-0.1,0.07,'MIN NON-IRR',0.0,11)
      CALL SYMBL4 (X,Y-0.22,0.07,'MAX IRRIGATED',0.0,13)
      CALL SYMBL4 (X,Y-0.32,0.07,'MIN IRRIGATED',0.0,13)
      RETURN
   12 CALL SYMBL4 (X,Y,0.07,'MEAN NON-IRRIGATED',0.0,18)
      CALL SYMBL4 (X,Y-0.1,0.07,'MEAN IRRIGATED',0.0,14)
   13 RETURN
      END

      SUBROUTINE SCALE (X,N,S,YMAX,YMIN,ID)
C
C     SCALE DATE IN ARRAY X DIMENSIONED BY N AND RETURN SCALED DATA IN
C     Y.  S IS THE MAXIMUM HEIGHT OF SCALED DATA, YMAX HAS MAXIMUM
C     ALLOWED DATA AND YMIN THE MINIMUM.  SHOULD DATA EXCEED THESE
C     BOUNDS, THE ID NUMBER WILL BE PRINTED ALONG WITH THE DATA.
```

```
      DIMENSION X(N)
      SS = S / (YMAX-YMIN)
      DO 10 I=1,N
      IF(X(I).LT.YMIN) WRITE(6,101) ID, X(I), YMIN
      IF(X(I).GT.YMAX) WRITE(6,100) ID, X(I), YMAX
      X(I) = SS * (X(I) - YMIN)
   10 CONTINUE
      RETURN
  100 FORMAT(' CALL ',I2,5X,F10.2,' EXCEEDED ',F9.1)
  101 FORMAT(' CALL ',I2,5X,F10.2,' WAS BELOW ',F8.1)
      END

      SUBROUTINE READC (IYEAR,NDAYS)
C
C     READ ONE YEAR'S DATA SPECIFIED BY IYEAR.  THE FIRST CARD IS A DATA
C     HEADER CONTAINING THE YEAR, NUMBER OF DAYS IN YEAR AND LAST
C     RECORDED WIND VALUE OF PREVIOUS YEAR.  RETURN NUMBER OF DAYS IN
C     NDAYS.
C
      COMMON /PLOT0 /  XPLT(366), ITAPE
     A       /PLOT1 /  TPRE(366), YIRR(366), YIRR(366), YNIR(366)
     B       /PLOT2 /  SNCV(366)
     C       /PLOT3 /  HHUM(366), LHUM(366)
     D       /PLOT4 /  THRS(366)
     E       /PLOT5 /  PEVP(366)
     F       /PLOT6 /  WIND(366)
     G       /PLOT7 /  YMAX(366), YMIN(366)
     H       /PLOT8 /  YH5C(366), YL5C(366), ZH5C(366), ZL5C(366)
     I       /PLOT9 /  YHA1(366), YLA1(366)
     J       /PLOT10/  YHSS(366), YLSS(366), ZHSS(366), ZLSS(366)
     K       /PLOT11/  YHA2(366), YLA2(366)
     L       /PLOT12/  YHBG(366), YLBG(366), ZHBG(366), ZLBG(366)
     M       /PLOT13/  YHA3(366), YLA3(366)
      COMMON /LABELS/  DUMY(228), XL(4),   YL(4)
      REAL    CH(11)   /'  0 ', '   -', ' 10-', '   -', ' 20-', '   -',
     A                  ' 30-', '   -', ' 40-', '   -', ' 50 '/
      REAL HHUM, LHUM, NIWW, NIDW, IRWW, IRDW ,OLDW
      AVE(X,Y) = (X+Y)/2.0
C
    1 READ(ITAPE,200,END=999) IYR,NDAYS,OLDW
  200 FORMAT(2I4,F4.0)
      IF(IYEAR.EQ.IYR) GO TO 3
      DO 2 I=1,NDAYS
    2 READ(ITAPE,200,END=999)
      GO TO 1
C
C
    3 DO 4 I=1,NDAYS
      READ(ITAPE,201,END=999) RAIN, SNOW, SNCV(I), IRWW, IRDW, NIWW,
     A                        NIDW, HHUM(I), LHUM(I), THRS(I), PEVP(I),
     B                        CLCV, WIND(I), YMAX(I), YMIN(I),
     C                        YH5C(I), YL5C(I), YHSS(I), YLSS(I), YHBG(I),
     D                        YLBG(I), ZH5C(I), ZL5C(I), ZHSS(I), ZLSS(I),
     E                        ZHBG(I), ZLBG(I)
  201 FORMAT(5X,F3.2,4F3.1,2X,2F3.1,1X,2F3.0,F2.0,F3.1,F2.0,F3.0,/,
     A       5X,2F3.0,6X,12F3.0)
      XPLT(I) = I
      TPRE(I) = RAIN + SNOW*0.1
      YIRR(I) = -1.0
      YNIR(I) = -1.0
      IF(NIWW.NE.0.0) YNIR(I) = (NIWW-NIDW)*100.0/NIDW
      IF(IRWW.NE.0.0) YIRR(I) = (IRWW-IRDW)*100.0/IRDW
      IF(OLDW.GT.WIND(I)) OLDW = OLDW - 1000.0
      HOLD = WIND(I)
      WIND(I) = (WIND(I)-OLDW) * 1.6093+0.05
      OLDW = HOLD
      YHA1(I) = AVE(YH5C(I),YL5C(I))
      YLA1(I) = AVE(ZH5C(I),ZL5C(I))
      YHA2(I) = AVE(YHSS(I),YLSS(I))
      YLA2(I) = AVE(ZHSS(I),ZLSS(I))
      YHA3(I) = AVE(YHBG(I),YLBG(I))
      YLA3(I) = AVE(ZHBG(I),ZLBG(I))
```

```
      4 CONTINUE
        YDAYS = NDAYS
        CALL SCALE (XPLT,NDAYS,7.94,YDAYS,  1.0, 1)
        RETURN
    999 WRITE(6,500)
    500 FORMAT('-*******ERROR IN INPUT DATA FROM TAPE *****',//)
        STOP
C
C
        ENTRY MOIST
        CALL PLOT   (0.0,1.2,-3)
        N = 0
        DO 20 I=121,306
        IF(YIRR(I).LT.0.0) GO TO 20
        N = N + 1
        YIRR(N) = YIRR(I)
        XIRR(N) = XPLT(I)
     20 CONTINUE
        CALL SCALE (YIRR,N,1.28,50.0,0.0,29)
        CALL LINE (XIRR,YIRR,N,1)
        N = 0
        DO 30 I=121,306
        IF(YNIR(I).LT.0.0) GO TO 30
        N = N + 1
        XIRR(N) = XPLT(I)
        YNIR(N) = YNIR(I)
     30 CONTINUE
        CALL SCALE (YNIR,N,1.28,50.0,0.0,30)
        CALL DASH (XIRR,YNIR,N,0.04)
        CALL PLOT   (2.61,0.0,-3)
        CALL LINE   (XL,YL,4,1)
        DY = -0.05
        DO 10 I=1,11
        CALL SYMBL4 (-0.22,DY,0.07,CR(I),0.0,4)
        DY = DY + 0.13
     10 CONTINUE
        CALL SYMBL4 (-0.22,0.45,0.07,'PERCENT',90.0,7)
        CALL SYMBL4 (3.2,1.53,0.07,'SOIL MOISTURE (IRRIGATED)',0.0,25)
        CALL SYMBL4 (3.2,1.63,0.07,'SOIL MOISTURE (NON-IRRIGATED)',0.0,29)
        CALL PLOT (-2.61,-1.2,-3)
        RETURN
        END
```

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